NOVEMBER 1960

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

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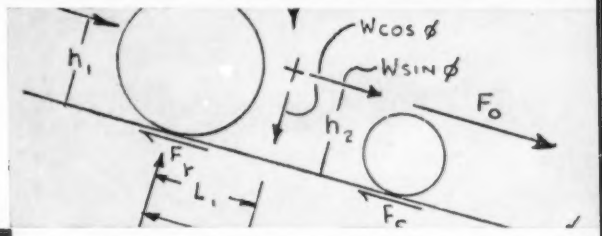

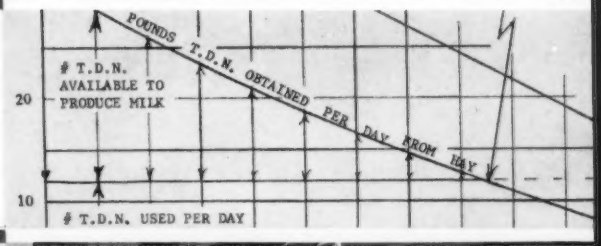

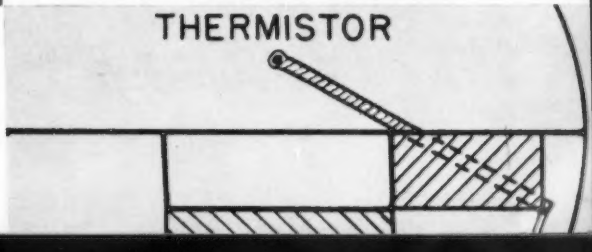

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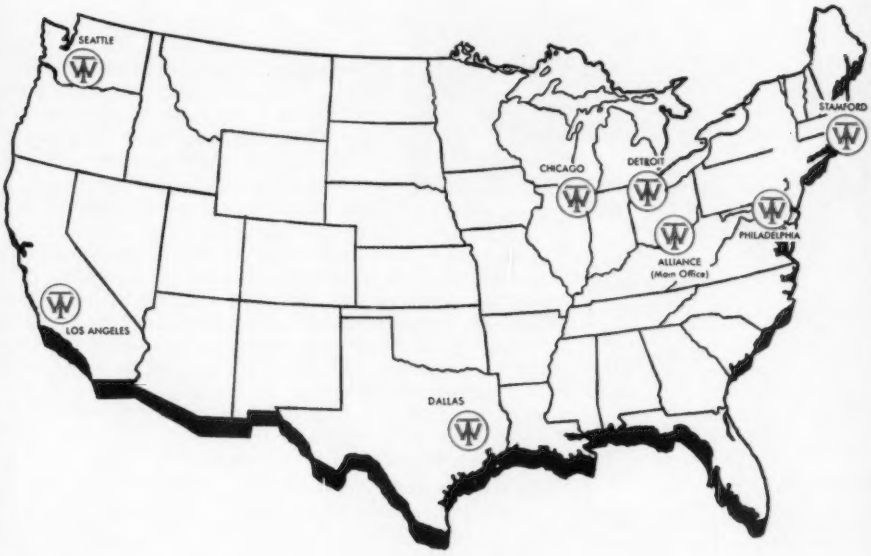

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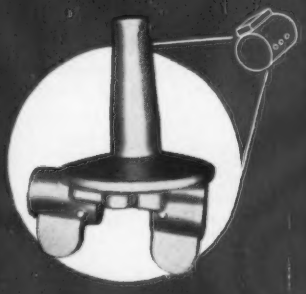

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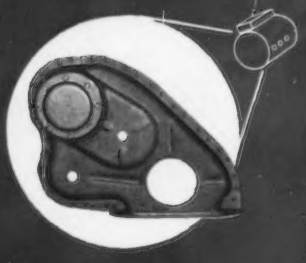

A welded assembly of both stamping and forging for a design of maximum strength. Part is 11 gauge and measures 17½" wide, 12¼" high and is 1¼" deep.

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Agricultural Engineering

Established 1920

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. . . Well Done

THE select group known as "Department Heads" is about to record in its annals the departure of two of its best known members. "Rod" Barden, chairman of the agricultural engineering department, Ohio State University, since 1955 has announced his retirement, and G. W. Giles, head of the agricultural engineering department, North Carolina State College since 1948 has resigned to accept a position with Ford Foundation on a 5-year mission to India.

R. D. Barden

Roderick D. Barden resigns his position as chairman of the agricultural engineering department, Ohio State University, after serving the University 36 years. A native of Shreve, Ohio, he was born March 26, 1900, and attended high school in Wooster, Ohio. He received a B.S. degree in 1923 and an M.S. degree in 1938 in agriculture from Ohio State University. He joined the OSU staff in 1924 as an extension agricultural engineer, and in 1946 became a professor of agricultural engineering.

Rod, as he was known to his many friends, obtained first-hand information on problems in agriculture by working on his father's farm until he completed college. He has also worked with farm groups and individual farmers for 22 years in solving machinery problems and working with farm programs. As an advisor, he worked with student groups in the field of agricultural engineering. He has done special problem work in the application of airplanes to agricultural practices.

He is a member of Gamma Sigma Delta and served on the Ohio State University Athletic Board.

G. Wallace Giles leaves North Carolina State College January 1, 1961, to go with the Ford Foundation on a 5-year mission to India, after 25 years as a member of the agricultural engineering department and 12 years as its head. In a statement prepared for publication Professor Giles states, "I feel that within my capabilities I have made the maximum contribution to the work and the development of the Department. The Department now has a highly competent staff in science to complement those in technology, as well as adequate facilities, including one of the finest agricultural engineering buildings now nearing completion. Included are outstanding research laboratories for scientific investigation of the physical applied to the biological. Additionally, we have a Ph.D. degree of note, joint administration by the schools of agriculture and engineering and an ECPD accredited curriculum. The Department now needs a new leader for a scientific age. It needs to establish new goals. In like manner, I need new challenges for continued growth and progress. The India mission is clear — increase food production 35 percent in five years. Nowhere in the world can more good be done for humanity."

G. W. Giles

Professor Giles has been active in regional and national affairs. He was instrumental in organizing the agricultural engineering section of the Tobacco Workers Conference and served as general chairman of the conference in 1956. He helped to organize the North Carolina Section of ASAE and has been active in many of its programs, particularly in establishing scholarships. In 1956 as chairman of the Southeast Section of ASAE, he appointed a committee to consider ways and means of bringing together all those concerned with the production and marketing of peanuts and of the processing and manufacturing into products for exchange of ideas and cooperative planning.

It's modern to design with concrete

In prestressed concrete the engineer has a completely new and up-to-date building material. Its properties allow the design of buildings with long unobstructed spans and minimum beam depths. These are both important in securing the flexibility of use demanded in today's farm structures.

This is the fourth of a series of reports showing design techniques with concrete applied to specific parts of a building. The explanation that follows shows why prestressed concrete is an ideal material for long span roofs. The table gives typical span lengths for double tee sections.

CONCRETE ROOFS...
"long spans a specialty"

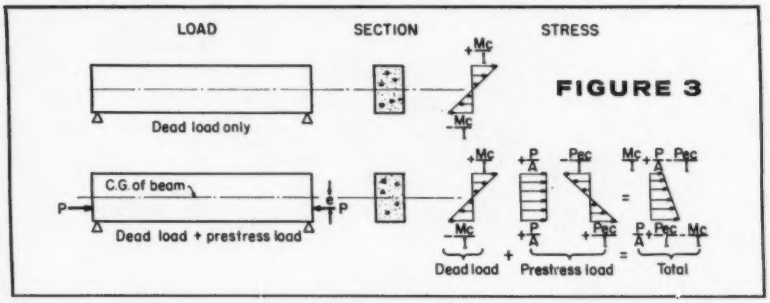

FIGURE 3

Prestressed concrete lends itself to construction of clear spans of unusual length. One of the reasons is that through prestressing, a stress pattern can be induced that completely counteracts the dead load stress of the beam. Thus the member is essentially weightless so far as its stress pattern is concerned. The entire strength of the beam is available to carry live loads.

Fig. 3 shows how this remarkable property is produced in a rectangular beam. By varying the magnitude of the prestress force, "P", and its distance from the center of gravity of the beam, "e", a total stress of the desired distribution can be obtained. Prestressed members have compressive stresses built into the bottom fibers. This cushion of compression counteracts the tensile stresses that are produced when a live load is applied. Through prestressing, concrete is utilized only in compression —a property in which it excels.

A tee, I, or box shape utilizes prestressed concrete more effectively than a rectangular section. Table 3 shows the general range of resisting moments available with double tee roof sections. The exact moment that a section will carry depends on the amount and location of the prestressing steel. The range of spans shown are for snow loads of 25 lb. per sq. ft. Manufacturers of prestressed roof sections furnish engineering guidance on selection of the member to fit the individual need.

Resisting Moments and Spans for Prestressed Concrete Double Tee Sections

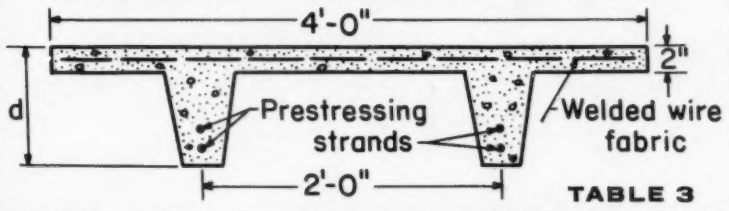

TABLE 3

Depth, d, Inches	Weight lb. per sq. ft.	Approximate Range of Carrying Capacity	
		Resisting Moment* ft.-kips per Double Tee	Allowable Clear Span for 25 psf Snow Load (ft.)
8	38	9 to 20	16 to 24
10	41	12 to 37	18 to 34
12	44	16 to 55	20 to 40
14	47	20 to 71	22 to 44

**including dead load moment*

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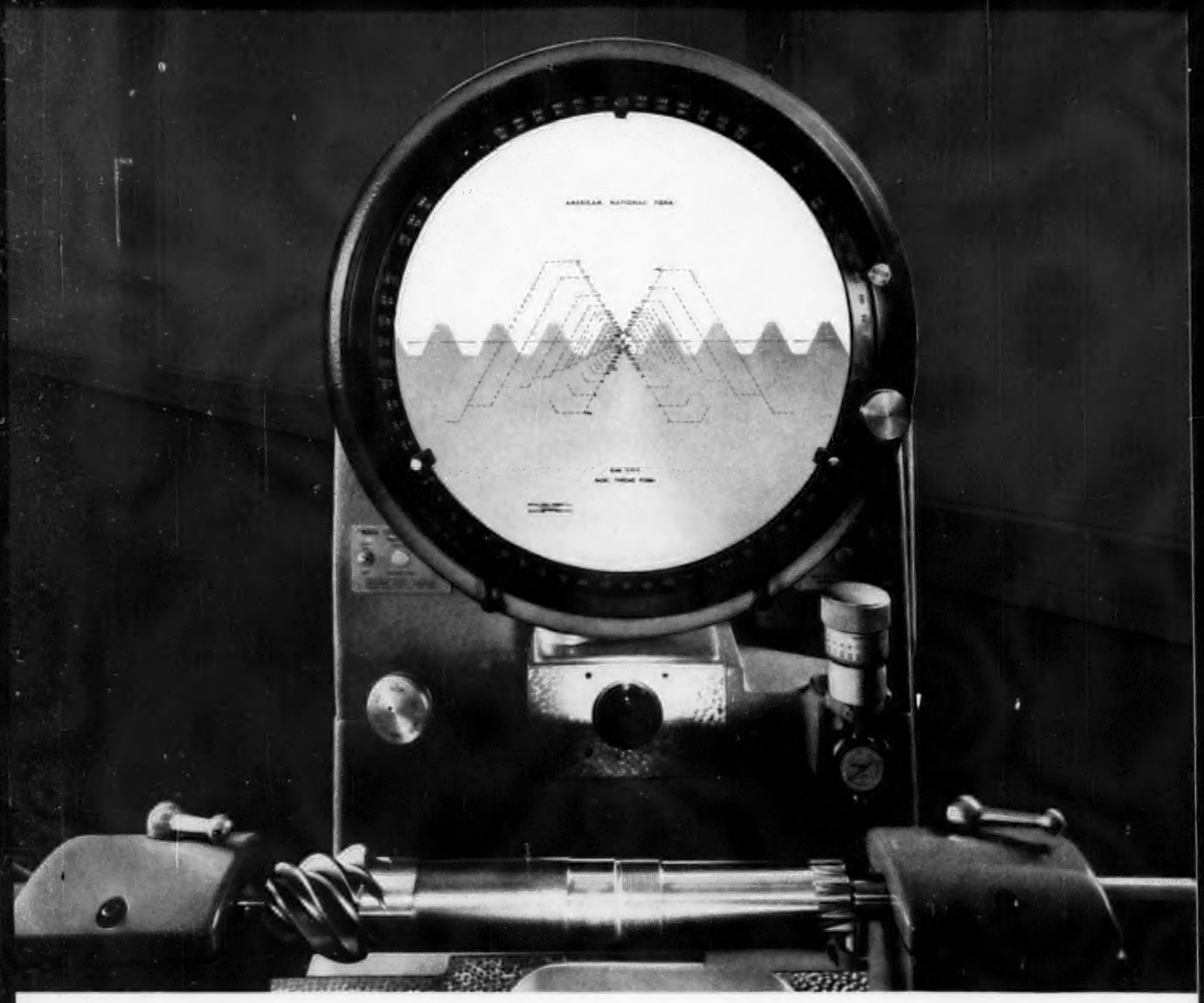

BETTER GEARS by making mountains out of molehills

This optical comparator is doing just that. The threads on the pinion in the foreground are magnified 31.25 times on the calibrated screen for intensely accurate inspection.

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NEW ONE-OF-A-KIND MICROGRAPH

draws pictures for bearing research

This greatly magnified stylus is drawing a picture of the microscopic imperfections in a bearing raceway . . . measuring each one to within a few millionths of an inch. The picture-on-tape which comes out of this specially modified micrological instrument is an important tool in BCA's research on ball bearing performance.

This is just one of the precision instruments in the Temperature-Humidity-Controlled Instrumentation Room which is the center of BCA research on bearings. The result of this program is revealed in on-the-job performance of BCA bearings. They roll dependably under heavy loads and all kinds of adverse conditions.

New testing facilities at the BCA laboratories also include specially designed equipment, often identical with equipment in customers' plants. Here, BCA bearings are tested to exceed customer specifications *under the exact operating conditions experienced by the customer!*

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Report to Readers . . .

RESEARCH RESULTS REPORTED ON AUGER CONVEYOR PERFORMANCE

In a summary of research findings, Cornell agricultural engineers report their investigations of the relationship of auger pitch to the capacity of the auger and the horsepower requirements under various operating conditions. With a nominal 6-inch auger elevator in conveying wheat, they used four different pitches of the screw ranging from a pitch length one-half the diameter of the auger to twice this diameter. (In these studies they were attempting to relate all pertinent auger values, so that prediction of capacities and power requirements of auger conveyors not tested might be possible.). . . . . The studies brought out these significant results: (1) The one-to-one pitch-to-diameter ratio will give maximum auger capacity; that is, auger pitch length should equal auger diameter for maximum capacity. (2) An auger conveyor with one-to-one pitch-to-diameter ratio has the twofold advantage of maximum capacity and minimum horsepower requirement, which in turn means maximum elevating efficiency. . . . . The Cornell engineers hope to be able to develop a general equation that will prove useful in predicting the performance of other auger conveyors.

ENGINEER DEVELOPS SIMPLIFIED BATCH-TYPE BALED HAY DRIER

This past season a Minnesota AES agricultural engineer, in cooperation with other experiment station personnel, has had under study an experimental, inexpensive, batch-type hay-drying unit, the cost of which was within $300. It was of wood construction and had a capacity for drying up to five loads of baled hay at a time. In the study made, 20-pound bales were used in random arrangement. Drying time for the hay, with heated air, varied from 10 hours for hay put in the drier at 30 percent moisture to 22 hours for that put in at 45 percent moisture. After drying, the bales were moved by elevator from the drying unit to the barn mow for permanent storage. . . . . The drying unit made up of two-by-fours, is 12 by 12 feet and 24 feet long, lined with plywood inside the frame members. Drying air is supplied by a portable drier. The heated air is blown in from the bottom of the drier. The structure is open at the top and during drying it is loosely covered by a tarpaulin.

HEADER ATTACHMENT FOR A GRAIN COMBINE HARVESTS SHELLED CORN

A USDA-Clemson College team of agricultural engineers has developed a simple, experimental header attachment for a grain combine, especially adapted to the requirements of farmers who want to shift from picking ear corn to harvesting shelled corn. The device costs less than available commercial attachments, but is expected to meet the needs of farmers growing limited acreages of corn. On test the header harvested 30 acres of corn in three days with a loss of ears of only about three percent in standing corn. While lodged corn presents more of a problem, the engineers recommend adding shields to the combine and header to improve performance.

FIELD CONVEYOR SPEEDS PICKING AND PACKING OF FRUITS AND VEGETABLES

A field conveyor designed and built locally this past season for a Michigan grower is said to have substantially reduced the time required for picking melons, tomatoes and cucumbers. With a crew of twelve it was possible to pick and pack 25 to 30 acres of melons in 10 hours, while in harvesting tomatoes a crew of nine was able to pick and pack 100 lugs an hour. . . . . The conveyor boom which is 30 feet long, mounts on the rear of a tractor and is operated by a hydraulic motor. The boom permits pickers to pick steadily and eliminates lifting, carrying and dumping of picking baskets. A trailer pulled by the same tractor permits "assembly line" packing of melons, for example, right in the field. . . . . For next season, this grower is considering a two-way conveyor that will cover a 60-foot swath.

(Continued on page 732)

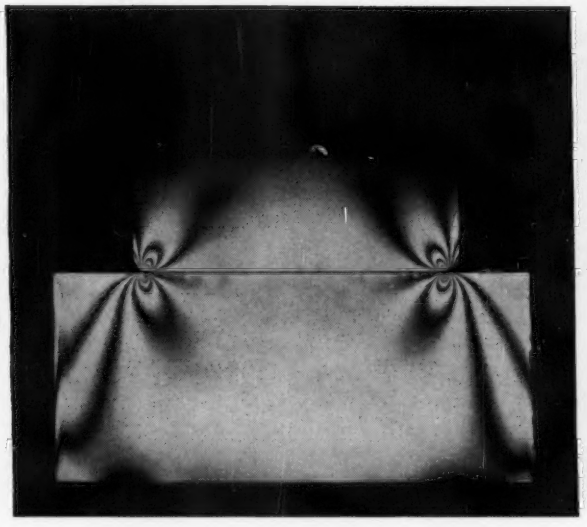
TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

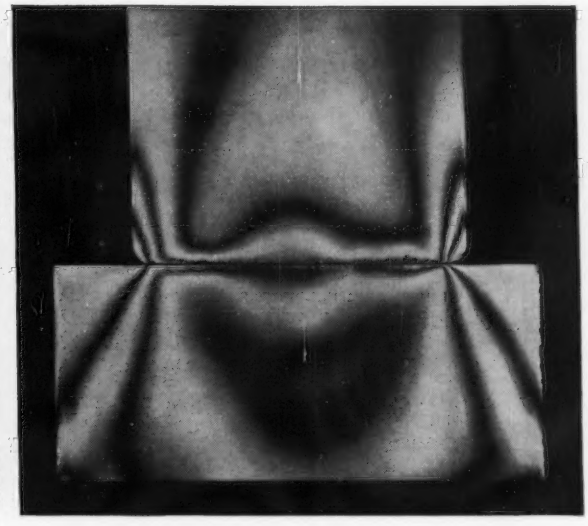
TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

One in a series of technical reports by Bower

BEARING BRIEFINGS

ROLLER BEARING LIFE AND CAPACITY LINKED TO STRESS DISTRIBUTION





These reproductions of photoelastic studies contain important evidence for every engineer and designer concerned with the performance and selection of roller bearings. In these photographs, the alternate dark and light areas, called fringes, indicate not only the magnitude of stress but also the stress distribution. The photographs were taken by Bower Research Engineers during a study of stress distribution in roller bearings.

The subjects represent rollers and raceways of two roller bearings under identical loads. The illustration at the left shows a roller of conventional design. The illustration at the right shows a Bower "Profiled" roller. That is, the roller is precision ground with a large radius generated along the body of the roller—a predetermined and controlled distance from each end.

The conventional roller photo (left) clearly shows how, under load, stress concentration builds up in and near the roller ends. This is called edge-loading. Such areas of concentrated stress are the breeding grounds for metal fatigue and eventual bearing failure.

In the photo of the "Profiled" roller (right) stress lines can be seen uniformly distributed across the whole length of the roller and raceway. There are no points of excessive stress concentration, consequently no starting points for early fatigue. Such a "Profiled" roller exhibits a great advantage in improved load carrying capacity, a most important bearing requirement.

Under actual operating conditions, Bower "Profiled" roller bearings show a considerably longer life at higher speeds and under greater loads than conventional roller bearings.

Because of this, and of other Bower features to be discussed in later technical reports, we suggest that you consider the advantages of Bower bearings in satisfying your future bearing requirements.

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Bower engineers are always available, should you desire assistance or advice on bearing problems. Where product design calls for tapered roller bearings or journal roller assemblies, Bower makes these also in a full range of types and sizes.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION — FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICHIGAN

. . . Report to Readers (Continued from page 730)

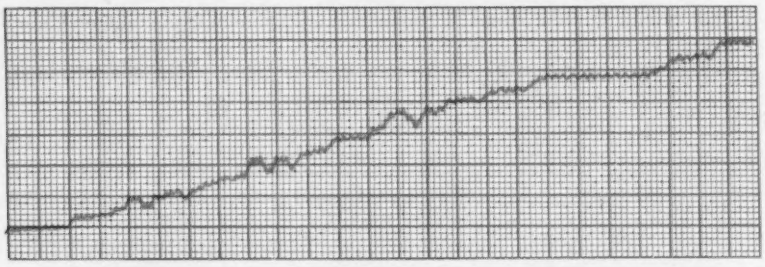
ENGINEERS DEVELOP HIGH-CAPACITY UNLOADER FOR HORIZONTAL SILOS Research agricultural engineers of the Washington (State) AES and the USDA Agricultural Research Service have announced that, as a result of a research project conducted jointly, they have developed an electrically powered unloader for horizontal silos that has shown up exceedingly well in performance tests. This unloader is an auger-type device and is powered by an electric motor. It is automatic in operation, and it is expected to have a capacity for unloading, conveying and distributing 175 to 200 pounds of silage per minute from a horizontal silo.

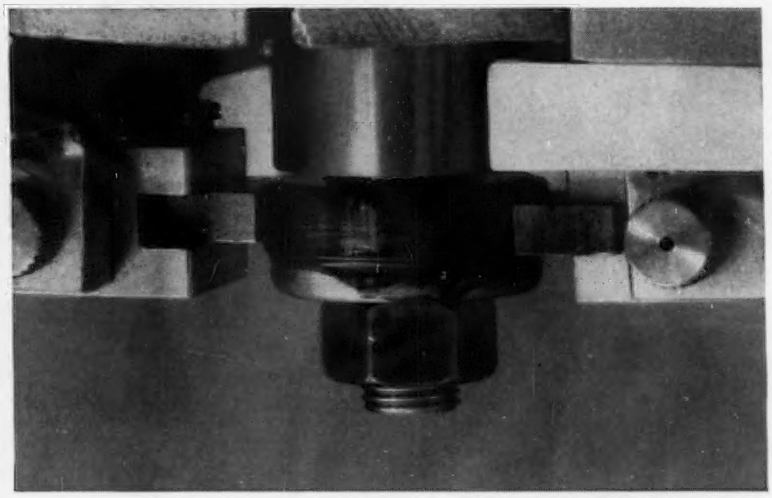
A ONE-MAN SYSTEM THAT MAKES, STORES AND FEEDS CHOPPED HAY A significant development in mechanizing hay production and feeding was reported to an ASAE meeting by the University of Missouri agricultural engineer who designed the system. The mow-storage space was divided into compartments by wire-mesh partitions 10 x 2 feet. The success of the system was due largely to conveyors specially designed for even distribution of the chopped hay over the mow compartments. (Blowing the chopped hay was found to result in separating leaves and stems and in uneven distribution of fine and coarse material, thereby making satisfactory drying impossible.) V-shaped feeding racks at the sides of the storage barn permitted feeding of the hay from each compartment in turn, and no forking of the stored hay was found necessary. . . . . Alfalfa cut at noon, crimped, chopped, conveyed to the mow bins, and dried beginning the same day resulted in a uniform, high-quality feed. Steers fed this hay required no protein supplement to make satisfactory gains.

ENGINEERS DEVELOP MECHANICAL FRUIT TREE PRUNER OR HEDGER A team of USDA-Michigan AES agricultural engineers appear to have made further substantial progress this past season in developing a satisfactory mechanical tree pruner. This pruner, or hedger, shears either peach or apple trees to a "box" shape by trimming all four sides and tops of the trees with an elevated mowing-machine-type cutter bar which is powered by a 6-hp gasoline engine mounted on a carriage that can be raised and lowered along a set of vertical rails. The rails are, in turn, mounted on a two-wheel trailer for hitching behind a tractor. . . . . From the tractor seat the cutter bar can be adjusted vertically, to heights ranging from 7 to 14 feet, for clipping the sides of trees and horizontally for trimming the tops. A sheet of canvas attached to the trailing edge of the cutter bar keeps the prunings from lodging in the trees. The hedger clipped limbs up to 1¾ inches in diameter. For this work the tractor was driven at a speed of 2 mph.

"TREE WALLS" FOR IMPROVING APPLE PRODUCTION EFFICIENCY A Michigan fruit grower of wide experience is growing an apple orchard that he plans to train into what he calls "tree walls." That is, he aims to develop this orchard so that he can prune it mechanically, harvest it at least semi-mechanically, and gain other operating efficiencies. . . . . Two years ago he planted standard-size trees 12 feet apart and in 18-foot rows, with the idea that they would grow together in the rows, thereby forming a solid wall of bearing surface about 14 feet high and 4 feet thick the full length of the row. In addition to a mechanical pruner, which is being designed to trim this orchard, it is planned to harvest the "tree walls" by having pickers ride a double-deck platform device and pick the fruit into bulk boxes as the platform moves along the tree wall. . . . Another advantage claimed for this type of orchard is that, in spraying a solid wall of trees, the spray efficiency would be several times that achieved in conventional orchards. Also, this Michigan grower says that an acre of tree walls would have more than twice the important outer bearing surface that an acre of globe-shaped trees would have; this he believes could mean higher yields, much as is the case in corn production when plant population is increased.

WE TAKE THE PULSE OF BEARINGS ON TAPE TO MAKE THEM EVEN BETTER!





TO TAPE-RECORD THE "HEARTBEAT" OF BEARING METALS UNDER LOAD, WE USE THIS SPECIAL FRICTION AND WEAR TESTER. (left) The result is highly accurate data on the behavior of bearing-metal surfaces, invaluable in our fundamental research into friction. By means of this instrument, we're able to correlate, more closely than ever before, specific alloy compositions with their degree of the "stick-slip" phenomenon (in which one surface sliding over another slides . . . stops . . . slides . . . stops . . . and so on) which accompanies unlubricated sliding action. We can also determine accurately the compatibility of bearing materials with shaft metals in lubricated systems . . . showing us which metal or alloy is most likely to be superior for a given bearing application. In short, this Friction Tester is a fundamental research tool which gives us positive answers to difficult bearing problems, faster than ever before.

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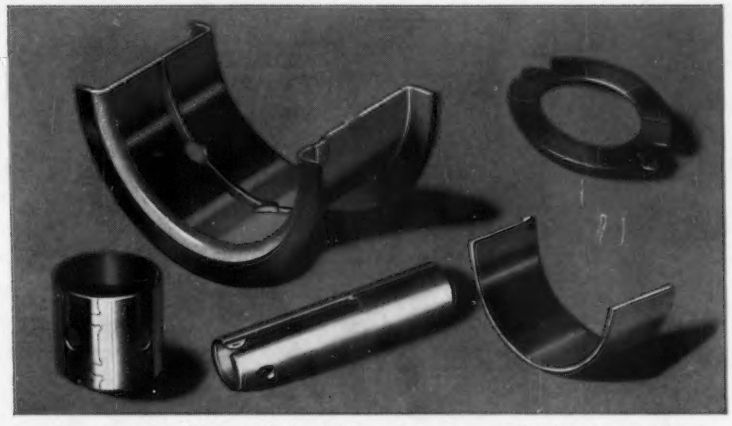

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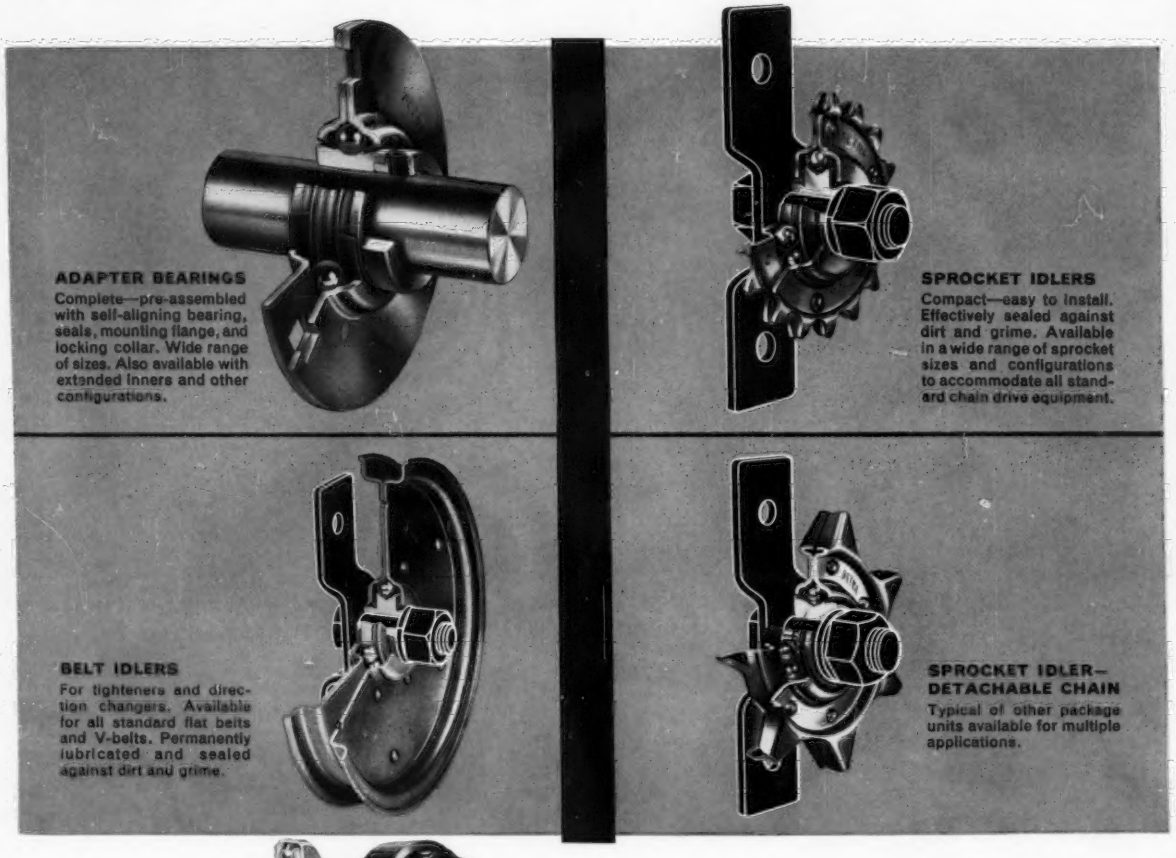

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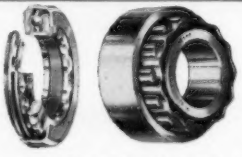

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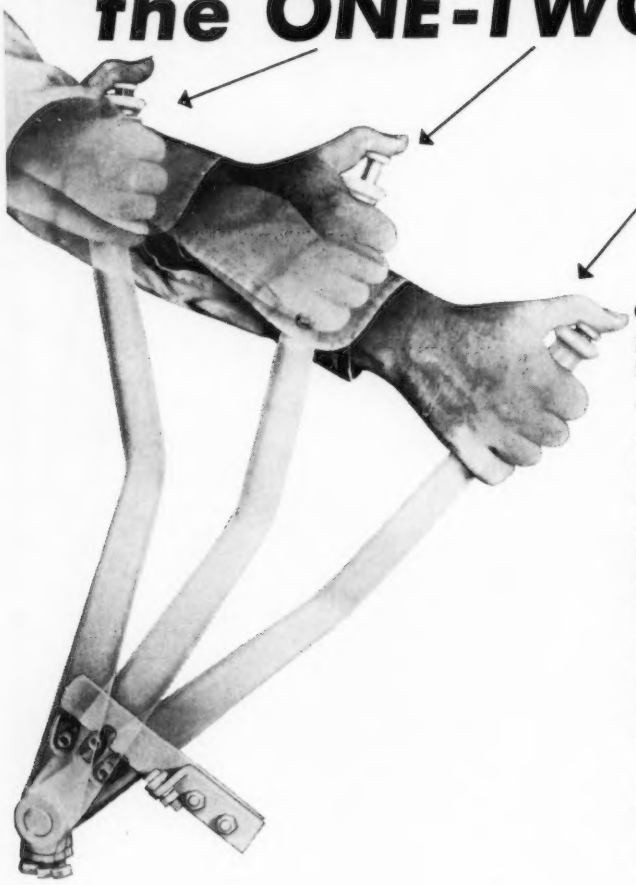

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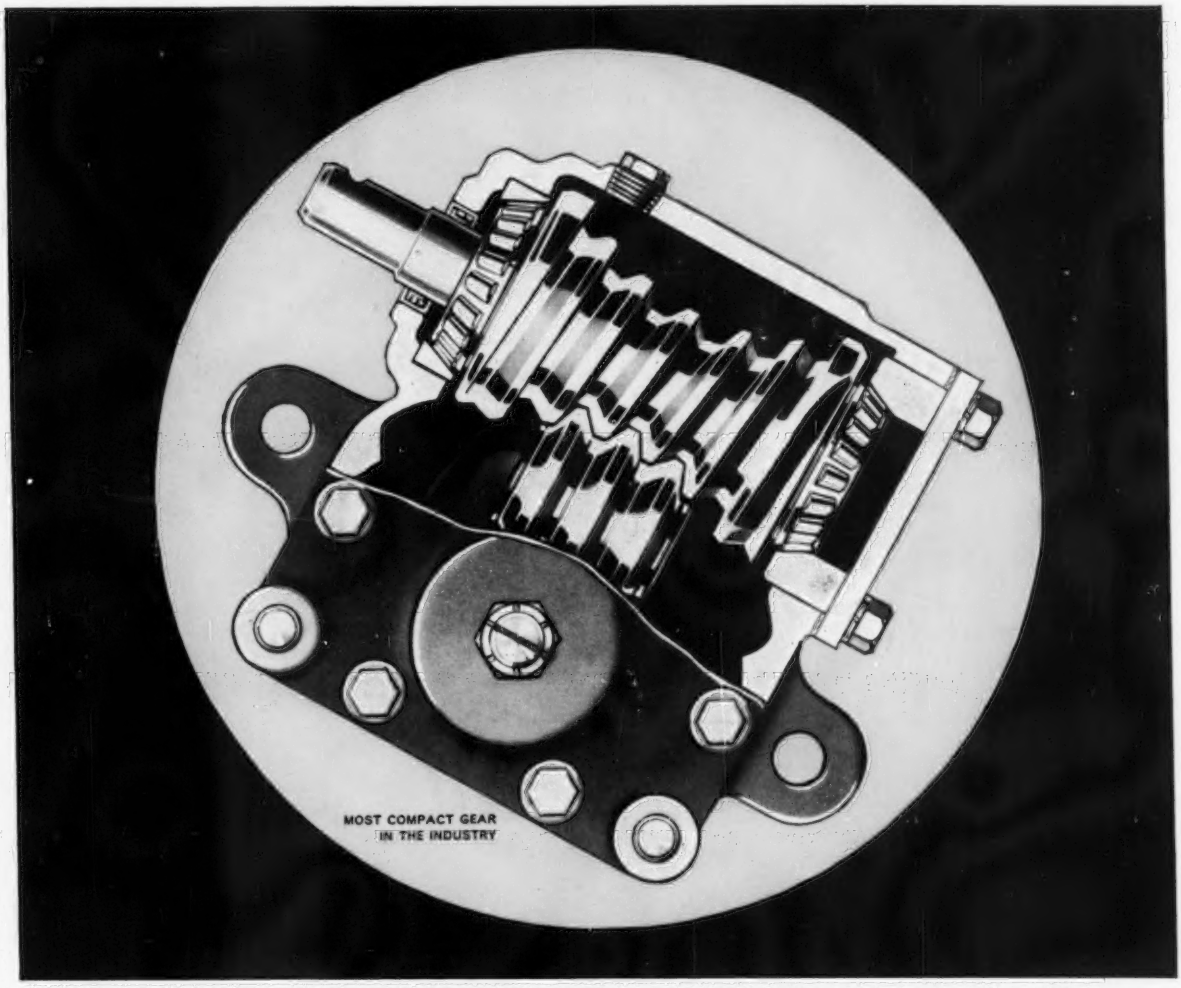

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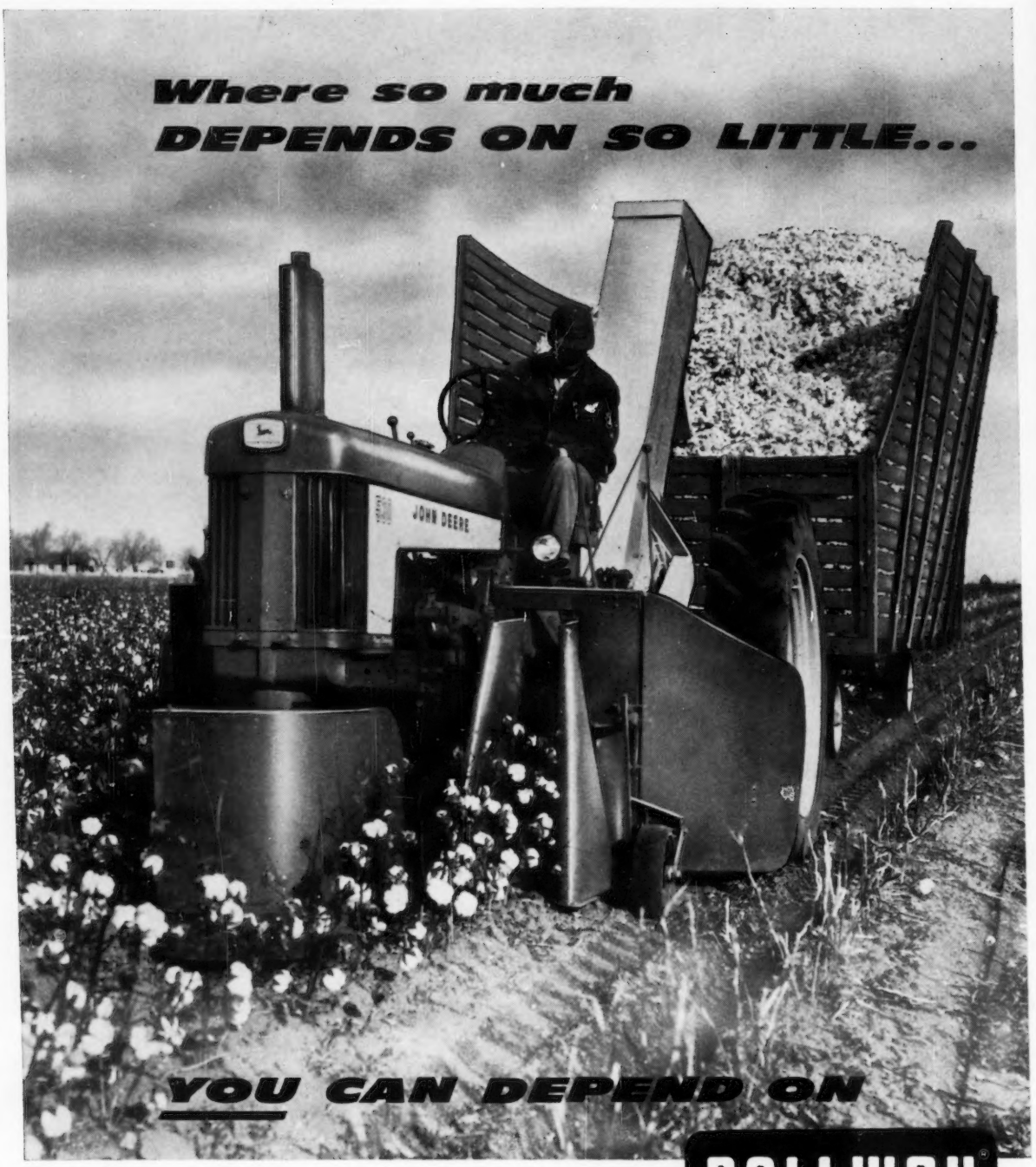

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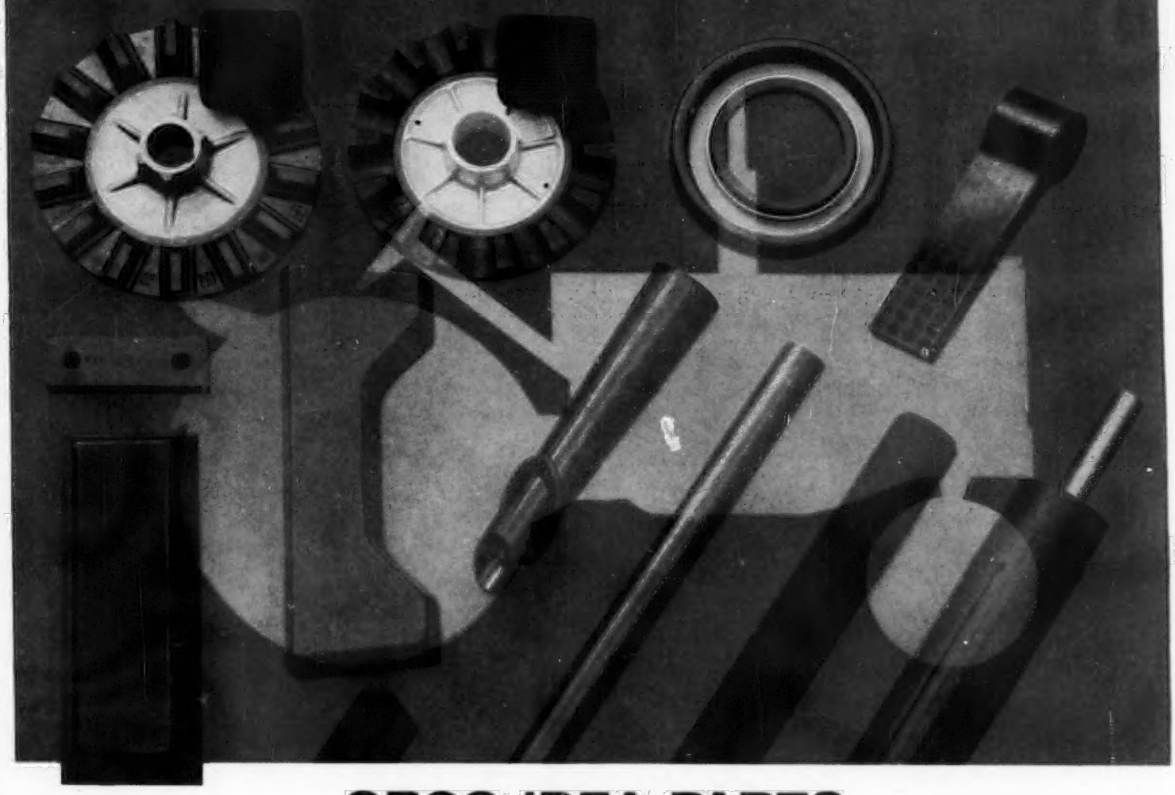

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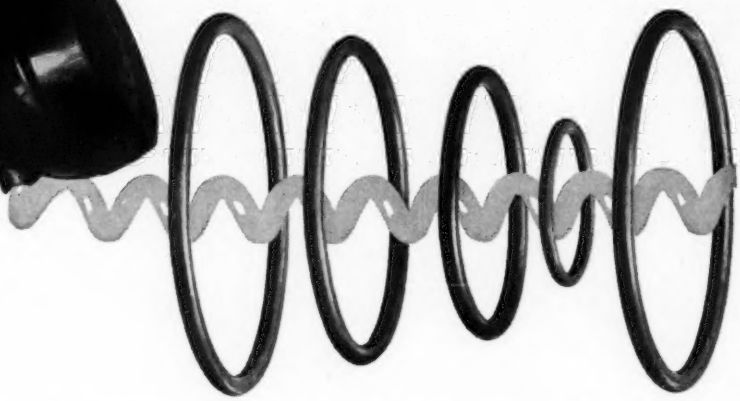

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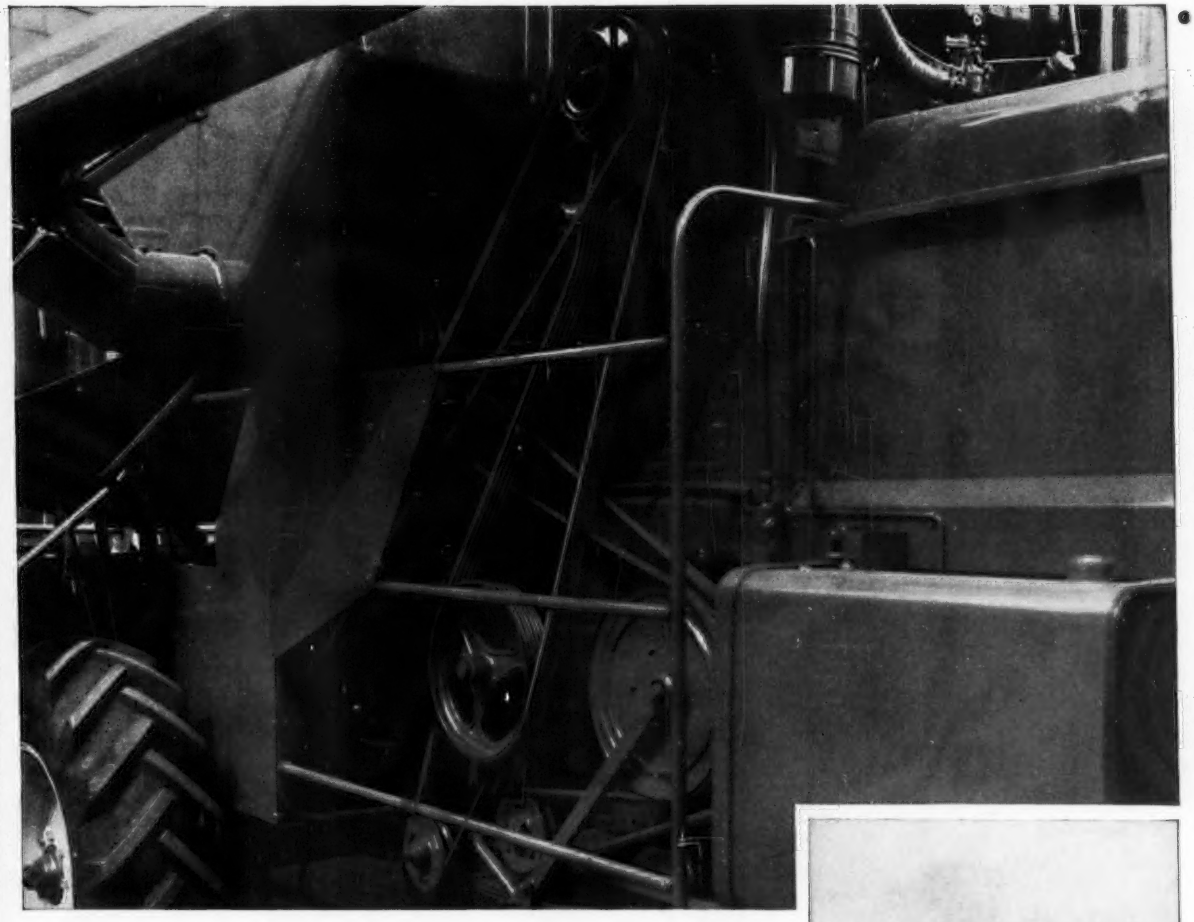

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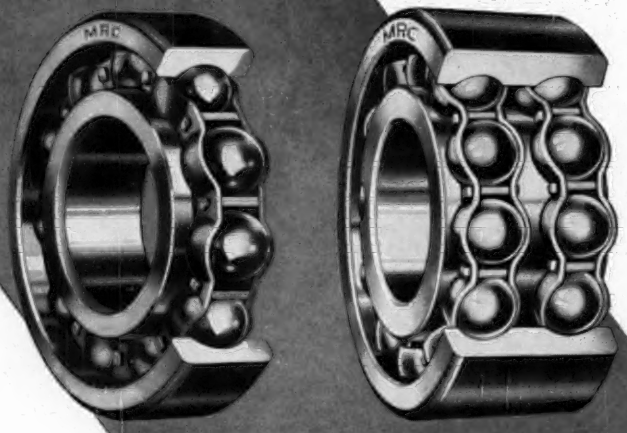

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Agricultural Engineering

November 1960
Number 11
Volume 41

James Basselman, *Editor*

Career Promotion Report

HOW do they like the movie? Undoubtedly, all who have been responsible for the development of the new ASAE career motion picture "Agricultural Engineering—The Profession With a Future" have at one time or another wondered how well their project would be received. Will the members like it? We have reported many favorable comments in previous issues. Now that it has been released will the members take every opportunity to see that it will be shown?

The following comments have been selected from recent correspondence to ASAE headquarters as representative samples of the response the film has been getting.

George Menard, Farm Director, WBBM-TV, Chicago —

"I am sorry to have kept the film in my possession so long, but I was determined to find a way to use it on our agricultural program, and finally used the film two days running and in two parts. This was more or less of an experiment, and it worked out very well. Reactions to the film were good."

F. P. Reiter, Audio-Visual Section, Los Angeles City Board of Education —

"May we obtain a print of your 16-mm sound motion picture 'Agricultural Engineering — Profession With a Future' for a period of one month, as soon as possible, to determine its value for use in many of our 550 Los Angeles City Schools? Our enrollment exceeds 600,000 and there are more than three thousand 16 mm sound projectors used by more than 22,000 Los Angeles teachers making possible continuous use of suitable films, year after year."

Wm. Mills, North Carolina Section —

"I know the movie has been shown once over the Raleigh television station and at a very opportune time. It came on between the World Series and a Football Game on a Saturday afternoon. The audience was undoubtedly quite large."

James E. Alford, Acting Chief of Distribution, USDA Motion Picture Service —

"A total of 38 television bookings have been arranged for the film, with a potential audience of 1,900,000 viewers (based upon the industry accepted figure of 50,000 for each public service film)."

Wm. F. Schwiesow, Agricultural Engineering Consultant, Texas Technological College—

"All indications are that the new film will be used quite extensively in this area. Mr. Williams has arranged for one TV presentation immediately before homecoming. Requests are coming in to the Audio-Visual Services booking in the film, and we are getting some direct response on the letters that we have sent out so far."

B. S. Myers, International Harvester Company —

"We would like to show the film to the Farm Equipment Research and Engineering Center so that our management will be able to evaluate it in terms of our operation."

A. J. Schwantes, Head, Agricultural Engineering Dept., University of Minnesota —

"It is quite possible that the Minnesota Section of ASAE will wish to obtain *an additional* copy of the career movie film."

Melvin Happe, Chairman, Pennsylvania Section —

"In addition to the literature I requested in my letter to you of September 1, I would very much appreciate receiving a print of the career motion picture. Most of the local schools will be opening next week, and I plan to show this film as soon as it will be convenient for the schools to arrange time for its presentation. Please bill the New Holland Machine Company for this film, and send the invoice and the film directly to my attention."

Romaine Smith, Young Folks Editor, *The Progressive Farmer*—

"Thank you for giving us the opportunity to preview your film, 'Agricultural Engineering — Profession With a Future.' This is an excellent presentation. We expect to call attention to it in the magazine in a future issue. We will also mention it on other occasions. A copy of the article will be sent to you. We are grateful to you for calling the film to our attention."

W. C. Wheeler, Head, Agricultural Engineering Dept., University of Connecticut —

"We feel that our ASAE display (including continuous showing of the motion picture) at Eastern States Exposition created considerable interest and was well worth while."

C. S. Morrison, Product Research Manager, Deere & Co. —

"Several of us from this office who saw the agricultural engineering movie at its premier showing in Columbus were quite favorably impressed. Please advise me as to how we might rent or borrow a print — for showing to a group of our company personnel at Moline."

Hans Sack, Institute of Agricultural Engineering, Technical University of Aachen, Germany —

"I read with great interest about your film 'Agricultural Engineering — Profession With a Future.' I am also of the opinion that such films are very effective in increasing the interest of agricultural engineering among young students entering the universities. I will be highly obliged if you will please furnish me with particulars."

Amin Aly Ibrahim, Head, agricultural engineering department, Alexandria University, Egypt —

"I want to congratulate you and the Society for the motion picture 'Agricultural Engineering — The Profession With a Future.' — We would like to know how we can obtain a copy of this film so that it will be a good advertisement for our profession."

Norman A. Evans, Head, Agricultural Engineering Dept., Colorado State University—

"I can report considerable demand for the use of the movie in Colorado already."

Fred Kummer, Head, Agricultural Engineering Dept., Auburn University, Alabama, sent us a comprehensive folder of information being used by section members in follow-up contacts as described in steps 3, 4, and 5 of the Five-Step Plan. Folder shows pictures of agricultural engineering building, agricultural engineering farm, student activities, awards and honors, classroom scenes, and contains information on value of college education, scholarships and loans available, and information concerning the local curriculum.

These are but a few of the reports reaching ASAE headquarters, but they represent great variety and scope for the motion picture effort to date. In general, most reports have been highly favorable and enthusiastic —but there is an ominous silence from some quarters. Are some areas going to neglect this, our best opportunity to promote our profession which has ever been made available to us?

Four-Wheel Tractor Braking

Tests indicate need for improved braking systems

K. E. Ryan and C. W. Terry
Assoc. Member ASAE *Member ASAE*

IN areas where tillable agricultural land is hilly, the investment in a machine designed specifically with this problem in mind or an attachment to existing machines that would increase the operator's safety in tillage operations is warranted. The number of annual farm fatalities alone points out the need for increased safety in farm equipment.

The purpose of this study was to achieve a better understanding of the principles involved in braking an agricultural tractor. Through this exposition, it was hoped that:

(a) Tractor braking capabilities and characteristics could be better realized

(b) Existing capabilities and characteristics could be improved upon and these improvements established.

Review of Principles Involved

When a vehicle with two axles has a velocity and the wheels on one axle are locked, this axle or end of the vehicle will lead in the vehicle's direction of motion (1)*, – more commonly stated: "The sliding end of a vehicle tends to lead." This is one important principle in the design of automotive and truck braking systems. It pertains to an agricultural tractor when the operator applies the brakes so as to slide both rear wheels with present rear wheel braking. The vehicle usually will "switch ends". This is hazardous, especially when there is a trailing implement that will "jacknife" with the tractor.

When four wheels are locked, the vehicle will slide in the direction of the inertia force along the line of travel. Likewise, when the front wheels are sliding they will not roll in the direction they are pointed and the vehicle will slide as a "unit" along the line of travel.

In addition to the principle that the sliding end of a vehicle tends to lead, there are three factors which involve transferring weight between axles. They are:

(a) The gravity component of the tractor's weight on hilly terrain

(b) The load placed on the tractor from a trailing implement

(c) The inertia force acting through the tractor's center of gravity during a positive or negative acceleration.

When a tractor is proceeding down a slope with a trailing implement and any brakes are applied, all three of these are factors in transferring weight from the rear axle to the front axle (Fig. 1).

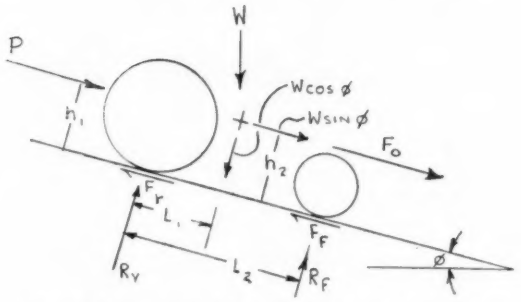


Fig. 1 Weight transfer during braking down a slope with a trailing implement

Where:

F_o = Inertia force acting through the tractor's center of gravity in direction of motion

ϕ = Angle of the incline

W = Tractor weight

P = Drawbar load

F_r, F_f = Rear and front braking forces

R_f = Front wheel reaction

R_r = Rear wheel reaction

h_1 = Height to line of action of drawbar load

h_2 = Height to the center of gravity

L_1 = Distance from rear wheel contact to the center of gravity

L_2 = Wheelbase

In this case, the total front wheels reaction R_f is:

(Sum moments about rear tire-surface contact and solve for R_f)

$$R_f = W \sin \phi\ (h_2/L_2)\dagger + P(h_1/L_2) - (W/g)\ (-a)\ (h_2/L_2) \quad [1]$$

$$= \left[[W \sin \phi + W(a/g)]h_2 + Ph_1 \right] (1/L_2)$$

This weight transfer is dependent upon the rate of deceleration $-a$ which is assumed constant for the above relationship. When all four wheels are sliding, the rate of deceleration $-a$ is greater, and the front axle will carry a higher percentage of the total vehicle weight, thus doing more of the total braking. This weight transfer is also dependent upon the traction coefficient μ. This can be seen by a summation of forces parallel to the ground surface. From Fig. 1:

Let F_4 = Braking force from four wheels

Forces = $O = P + F_o + W \sin \phi - F_4$, or $F_4 = P + F_o + W \sin \phi$ . . . . . [2]

Since $F_4 = \mu\ W \cos \phi$, any change in μ changes the magnitude of the braking force F_4.

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Ohio State University, Columbus, June 1960, on a program arranged by the Power and Machinery Division.

The authors – K. E. RYAN and C. W. TERRY – are, respectively, test and development engineer, International Harvester Co., Hinsdale, Ill., and professor of agricultural engineering, Cornell University, Ithaca, N. Y.

*Numbers in parentheses refer to the appended references.

†This is only approximate since center of gravity and axles are not the same height.

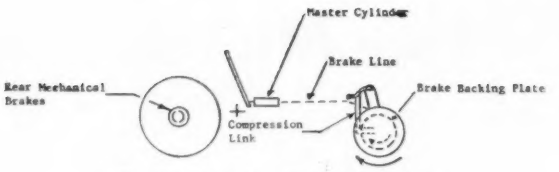


Fig. 2 Test tractor with braking system

In some instances four-wheel braking on the traction vehicle is inadequate. When a tractor is trailing two implements in series; such as, a baler or a field forage chopper with a wagon hitched behind, a good braking system on the tractor will not insure control at all times. Most choppers and recent balers are relatively light in weight in comparison to the trailing load behind them. During side hill harvesting operations, the heavily loaded wagons are capable of forcing the baler or chopper into a jackknife. In this case, braking on the wagon wheels is necessary. The limit to four-wheel braking (assuming equal traction coefficients) is the maximum load that the tractor can pull when all of the weight has been transferred to the drive wheels.

Testing Procedure

A four-wheel braking system was constructed on a two to three-plow general-purpose tractor (Fig. 2).

To measure the braking force from each front wheel the brake assembly backing plate was mounted on bearing surfaces on the spindle, thus leaving it free to rotate. A vertical compression link was mounted behind each front leg of the tractor. Application of the brakes caused a slight rotation of the backing plate, thus placing the vertical link in complete compression when going forward or tension when backing. To eliminate bending in this link, it was mounted with full ball and socket joints at each end. The deflection of the link was measured with a resistance strain gage bridge (3) placed on each link, and compared to a calibrated known braking force.

For each of the variables affecting braking characteristics, the following tests were run:

(a) Front-wheel brakes only
(b) Rear-wheel brakes only
(c) Four-wheel brakes

Variables that were considered as affecting braking characteristics are:

(a) Rate of deceleration (stopping distance)
(b) Velocity
(c) Trailing implement
  1. Drawbar height
  2. Drawbar load
(d) Percent grade
(e) Direction of travel
(f) Type of surface
(g) Vehicle weight

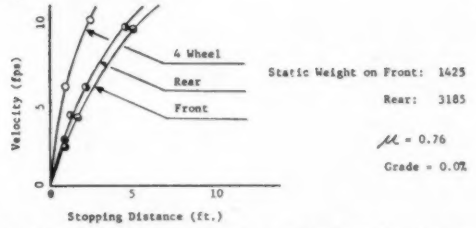


Fig. 3 Curve of stopping distance vs. velocity on blacktop surface

In every case, stability and ease of control of the tractor were observed.

Deceleration and Stopping Distance

The variables measured in these tests were:

(a) Time to stop
(b) Distance to stop
(c) Tractor velocity
(d) Coefficient of traction

Results

As shown in Fig. 3, the stopping distance for front sliding and for rear sliding at velocities up to 10 fps are nearly identical. Considering the static weight on front (1425 lb) and rear (3185 lb), appreciable weight has been transferred from the rear axle to the front due entirely to the inertia of the tractor.

On a sod grade (Fig. 4), the application of front wheel brakes greatly increased tractor stability. The distance and time to stop were reduced approximately 50 percent with the addition of front braking. Weight transfer to the front axle is a function of the traction coefficient μ and was, therefore, less on the sod tract (μ=0.50) than on the blacktop track (μ=0.76).

A comparison of stopping distance and direction of travel for one velocity is shown in Fig. 5. Braking while traveling forward shifts weight toward the axle with less weight while the opposite is true when braking in reverse gears.

Braking with a Trailing Load

Variables recorded in these tests were:

(a) Drawbar load (pounds push)
(b) Brakes applied (front or rear)
(c) Traction coefficient

(Continued on page 751)

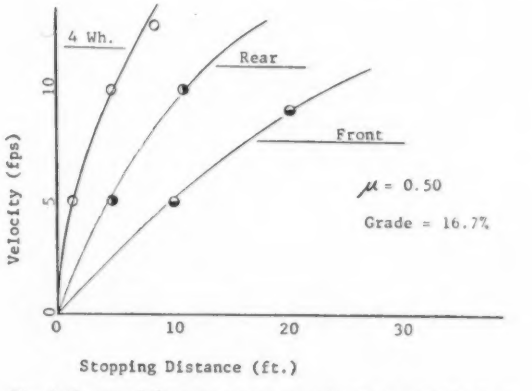


Fig. 4 Curves of distance to stop vs. velocity on a sod incline

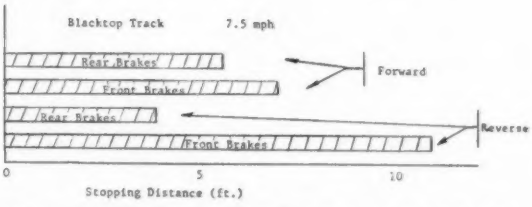


Fig. 5 Stopping distance: Reverse vs. forward, on level track

Quality Control in Hay Making

James H. Oliver
Member ASAE

THE quality of hay grown in the United States has improved greatly in the last 50 years, but the quality of hay fed to farm animals during the winter months still leaves much to be desired. We either cut hay too late, when it has become coarse, stemmy, unpalatable and low in digestibility, or we lose a large percent of its feeding value — 25 to 40 percent or more — due to weather damage by field curing it or 15 to 30 percent when put up as grass silage.

Agricultural engineers have been showing farmers for 19 years how the installation of mow hay drying equipment can be made to eliminate a large part of the weather hazard. However, this has not been enough to convince all or even a large percent of the dairy or beef farmers that they should use drying equipment as a regular practice.

Grass silage at one time seemed to offer the solution to beating the weather, but its popularity seems to be steadily diminishing. A recent survey in Wisconsin, published by the *Wisconsin Agriculturist,* showed that 71 percent of the farmers, who reported they had put up grass silage for several years, had discontinued it and had gone back to putting up all their grass as hay. I found a similar situation in eastern New York in the spring of 1959. Dairy farmers there had already dropped or were planning to drop grass silage that year and put up all their grass as hay. The chief reason seemed to be that the cows would not or could not eat enough grass silage to produce the amount of milk they were capable of producing on hay and corn silage with the same grain feeding.

More recently the hay conditioner has enjoyed a wave of popularity because it reduces field-curing time, making it possible to cut hay one day and store as dry hay the next day in good haying weather. Of course, it has been standard practice for years to cut hay one day and store the next where hay-drying equipment has been installed. The overall cost of conditioning hay is about 50 cents per ton less than that for drying, but the additional leaves saved, when hay is raked and baled or chopped at 35 to 40 percent moisture instead of at 20 percent, easily outweighs the extra cost. Thus, if a decision has to be made whether to buy a conditioner or a hay drier, the hay drier should be the first choice, as it is the more profitable investment.

The real choice, however, is that the farmer should have *both* — a mower and conditioner, or an equivalent machine, to cut and crush the hay so that it can be cut in the morning, with a moisture content of 75 to 80 percent, and baled or chopped in the afternoon at 35 to 40 percent with drying completed under cover to save maximum feed value.

Too few farmers realize that it is now possible to make hay in one day every good haying day, without having to worry about what the weather will be like tomorrow or the next day. Even on relatively poor haying days, or in areas of high humidity, where a heated air drier is used to dry hay overnight on wagons to keep labor to a minimum, hay can be baled the same day as cut with a moisture content as high as 45 percent (or even 50 percent if necessary to avoid having the hay rained on) and still be dry the next day ready to dump into the mow.

Even if the farmer has a hay conditioner and a drier, he will be wasting his time and money using them as long as he continues to cut his hay in the full bloom to seed stage. The real value of the hay conditioner and drier is that they permit the farmer to make hay early in the season when hay is in the prebud to one-tenth bloom stage, when it is high in both digestible protein and total digestible nutrients (TDN).

This is the real problem we have today — to show the farmer, with real facts and figures, how much it will pay him to change his haying practice. He has to cut his hay early, starting not later than June 1 in the Northeast, (alfalfa-orchard grass mixture was ready for cutting May 25) and the first cutting completed before June 20 to get quality hay. This early cut hay should be baled or chopped the same day as cut, at 35 to 40 percent moisture to save the leaves which are 75 percent digestible, and dried in the mow with natural air, or on wagons over night with heated air, to keep total losses down to a maximum of 10 to 15 percent. Reports from Cornell University show farmers can get 27 percent more milk per acre or as much as 1700 lb more milk per cow per year by early cutting. This is an increase of $50.00 to $75.00 more milk per cow per year, or as Michigan State University reported in February, 1959 — $900 to $1500 additional income for each 20 cows milked.

Thus the increase in income from twenty or more cows fed early cut barn-dried hay will pay for a hay-drying installation in one year or a hay drier plus hay conditioner in two years. If he milks 50 to 60 cows or more, the increased income, $3,000 to $4,000 per year, will easily pay in two years for both the conditioner and a heated-air system for drying on wagons.

These values of additional milk or extra income per cow are excellent information, but in addition to quoting them to farmers we have to show *why* and *how* he can get the same kind of results as others are getting with hay drying.

Almost every good dairy farmer knows that early cut hay is better than late cut hay in producing milk and most of them know that an early first cutting will produce more milk per pound of hay than the best second cutting. Our problem is to show them *how much* the quality of the early cutting is better so they can see for themselves *why* it will pay them to start haying one to three weeks earlier than they have in the past.

This is best illustrated by showing:

(a) How hay consumption per day varies depending on when the hay was cut, and how milk production or meat production is affected

(b) How the percent digestibility or the TDN of the hay drops as hay matures, and

(c) How rapidly the percent digestible protein drops as hay matures.

If the pounds of hay consumed per day is multiplied by its percent digestibility, the result is the TDN that the cow obtains from the hay consumed. From this TDN the cows use part to maintain body weight, part to produce a calf, and what is left over to produce milk or get fat.

To illustrate this and to keep the calculations simple, the cow will be fed only hay and water so that any milk produced will have to come from the hay eaten. The effect of adding grain will be considered later.

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Cornell University, Ithaca, N. Y., June 1959, on a program arranged by the Electric Power and Processing Division.

The author — JAMES H. OLIVER — is manager of sales promotion, Aerovent Fan and Equipment, Inc., Lansing, Mich.

Tests on hay consumption reported by Cornell University in 1955 show that dairy cows will consume 3 lb of hay per day per 100 lb of body weight if the hay is cut in the prebud stage, i.e., the first week of June in central New York. One test using 750-lb dairy heifers showed consumption as high as 4.5 lb per 100 lb of body weight when they were fed hay cut May 25.

As the hay matures it becomes more stemmy, woody, less palatable and harder to digest. The result is that cows eat less of it — as little as 2 lb per day when the hay is in the full-bloom stage. Only 1½ lb per day per 100 lb of body weight is consumed when hay is cut in mid July in the seed stage.

Referring to Fig. 1 and applying this data to a 1500-lb cow, we find that hay consumption drops from 45 lb per day, for hay cut the first week of June in the vegetative stage, to 22 lb per day for hay cut in mid July in the seed stage, a decrease of about 4 lb per day for each week cutting is delayed after June 1 in this area.

Referring to Fig. 2, it is next found that the percent digestibility drops about ½ percent per day for each day hay is left uncut after June 1 — from 70 percent digestible in the vegetative state June 1 to 50 percent digestible by July 15 when in the seed stage. Other areas have indicated the drop is even greater —to 40 percent digestibility when in the seed stage.

The digestibility of the second cutting (Fig. 2) does not drop as fast as the first, but the best we can hope for is about 63 percent for hay cut 30 days after the first cutting. Thus it can be said:

(a) The best second cutting is not as good as a first cutting made before June 15 in the northeast, but is better than any late cut hay.

(b) Hay cut the first week of June has about the same digestibility as dairy

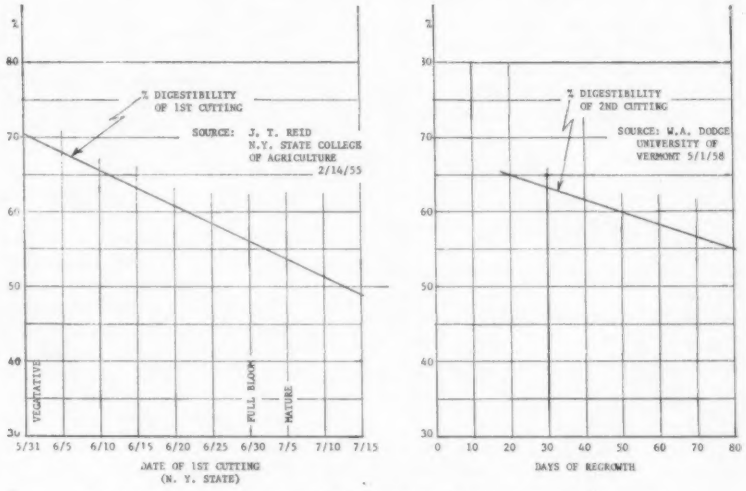

% DIGESTIBILITY OF 1ST CUTTING
SOURCE: J. T. REID N.Y. STATE COLLEGE OF AGRICULTURE 2/14/55
VEGETATIVE
FULL BLOOM
MATURE
5/31 6/5 6/10 6/15 6/20 6/25 6/30 7/5 7/10 7/15
DATE OF 1ST CUTTING (N. Y. STATE)
% DIGESTIBILITY OF 2ND CUTTING
SOURCE: W.A. DODGE UNIVERSITY OF VERMONT 5/1/58
0 10 20 30 40 50 60 70 80
DAYS OF REGROWTH

Fig. 2 Percent drop in digestibility for each day hay is left uncut after June 1

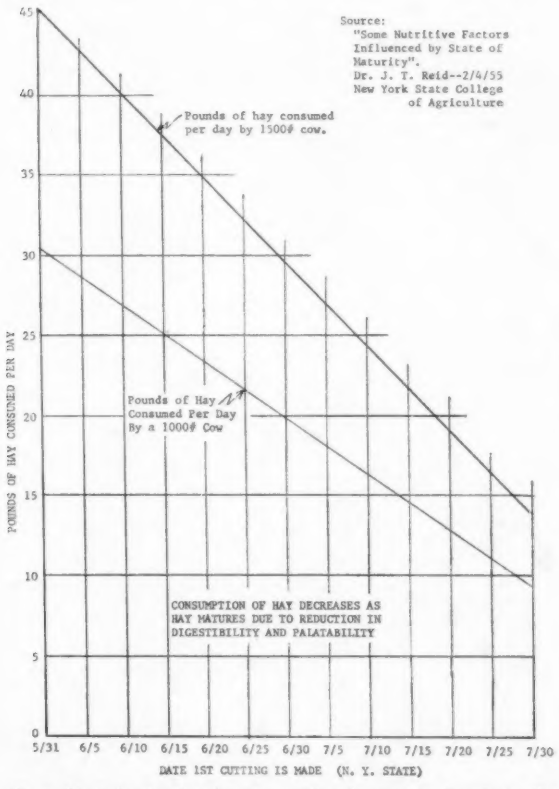

Source:
"Some Nutritive Factors Influenced by State of Maturity".
Dr. J. T. Reid--2/4/55
New York State College of Agriculture
Pounds of hay consumed per day by 1500# cow.
Pounds of Hay Consumed Per Day By a 1000# Cow
CONSUMPTION OF HAY DECREASES AS HAY MATURES DUE TO REDUCTION IN DIGESTIBILITY AND PALATABILITY
POUNDS OF HAY CONSUMED PER DAY
5/31 6/5 6/10 6/15 6/20 6/25 6/30 7/5 7/10 7/15 7/20 7/25 7/30
DATE 1ST CUTTING IS MADE (N. Y. STATE)

Fig. 1 Chart showing that hay consumption decreases as it matures after June 1, due to reduction in digestibility and palatability

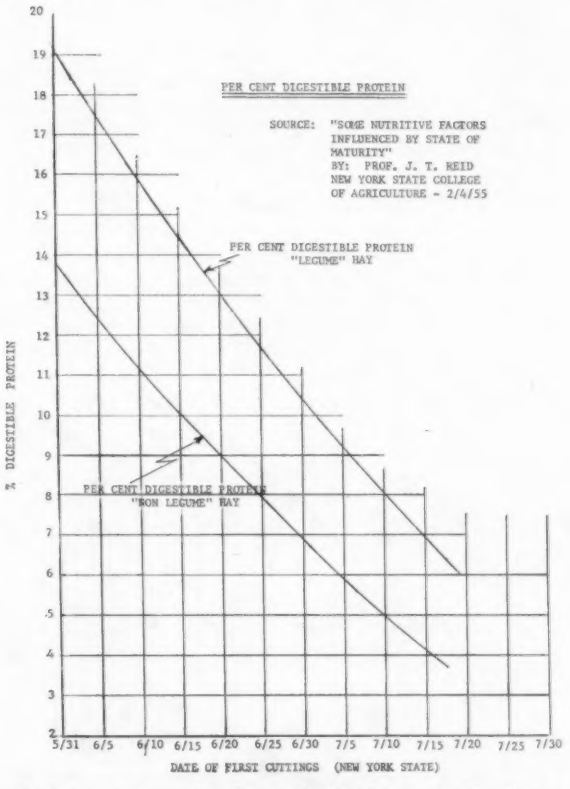

PER CENT DIGESTIBLE PROTEIN
SOURCE: "SOME NUTRITIVE FACTORS INFLUENCED BY STATE OF MATURITY" BY: PROF. J. T. REID NEW YORK STATE COLLEGE OF AGRICULTURE - 2/4/55
PER CENT DIGESTIBLE PROTEIN "LEGUME" HAY
PER CENT DIGESTIBLE PROTEIN "NON LEGUME" HAY
% DIGESTIBLE PROTEIN
5/31 6/5 6/10 6/15 6/20 6/25 6/30 7/5 7/10 7/15 7/20 7/25 7/30
DATE OF FIRST CUTTINGS (NEW YORK STATE)

Fig. 3 Percent drop in digestible protein of both legume and non-legume hay after June 1

. . . Quality Control in Hay Making

rations purchased from the local feed dealers at $65 to $75 per ton. If milk cows could be fed this kind of hay the year around, we could easily produce 70 to 80 percent of the milk from roughage and eliminate the need to purchase high protein supplements. Home-grown grain would be adequate to supplement the hay.

Referring to Fig. 3, early-cut barn-dried hay is regularly reported as containing from 17 to 20 percent digestible protein. A report on 1956 hay drying with heated air by the University of Missouri showed that a first early cutting consisting of a mixture of 60 percent orchard grass and 40 percent alfalfa, measured 19.4 percent digestible protein. The second cutting of alfalfa from the same field, which was also dried with heated air measured 17.8 percent digestible protein.

With this kind of information it can be easily seen that to get quality hay — high in protein and TDN, the first cutting must be completed by June 20 at the latest. A hay drier is almost an absolute necessity to meet this date, the addition of a hay conditioner makes it a little easier.

Again using a 1500-lb cow as our example, by multiplying the pounds of hay consumed by its percent digestibility, the TDN the cow gets from the hay is found. From this total this cow will use an average of about 12 TDN per day to maintain her body weight and produce a calf. What is left over can be used to produce milk or put on weight. Thus TDN from hay consumed less 12 gives the TDN available to produce milk.

Referring to Fig. 4, a little arithmetic will show that the 1,500-lb cow has nearly 20 TDN available to produce milk when fed hay cut the first week of June, but that it drops rapidly to reach zero TDN for milk production by July 10. This point of zero TDN for milk production is reached by July 4 by a 1,000-lb cow. Thus any milk produced by cows fed hay cut after July 4-10 will have to come from grain fed, as all the TDN the cow gets from the hay she eats will be used to maintain body weight.

From Fig. 5, it may be seen what this cow should do in producing milk from hay consumed. It can also be seen that, as a result of the decrease in TDN available for milk production from hay consumed, milk production must drop 10 to 12 lb per day for each week haying is delayed. With a 200-day winter feeding, moving the cutting date up only one week can result in an extra ton of milk per cow from hay, an extra $60 income per cow each year. Where hay is fed 300 to 365 days, as many dairy farmers now do, the increase can be nearer $90 at $3 per 100 lb of milk.

At a hay-drying meeting in Vermont in May, 1958, W. A. Dodds of the University of Vermont, reporting on feeding tests of hay cut before June 9, told us that one of their 1,500-lb cows ate 50 lb of hay per day and produced 70 lb of milk on a hay and water diet — no grain or silage was fed. That was 1.4 lb of milk for each pound of hay consumed, or 2,800 lb of milk per ton of hay. From Figs. 1 and 5 it may be seen that hay cut before June 15 should produce at least one pound of milk (3.5 percent butterfat) per pound of hay.

Facilities are now available and if used properly farmers can get $80 to $100 of milk per ton of early cut barn-dried hay fed in this area where milk is $4 or more per 100 lb. Quality hay has in time past been called "green gold." It is the most profitable crop we can grow in this area for feeding dairy or beef cattle or sheep.

In other areas it compares very favorably with wheat or corn in gross return per acre. Let us examine the return from one acre of land producing 100 bu of corn or 50 bu of wheat or 4 tons of hay (three cuttings) cut at the right stage of maturity and barn dried.

(Continued on page 761)

A yield of	Approximate gross return per acre
50 bushels of wheat (cash crop)	= $100 approximate
100 " corn (cash crop)	= $110 "
100 " corn (fed to hogs)	= $160 - $190 ($250 in air-conditioned house)
4 tons hay fed to good dairy cows	= 8,000 lb milk at $3.00 per 100 lb = $240 or $4.00 per 100 lb = $320
or 4 tons early cut barn-dried hay fed to 450 to 600-lb beef steers or 750-lb dairy heifers will produce 800 lb gain at 25¢ per pound	= $200

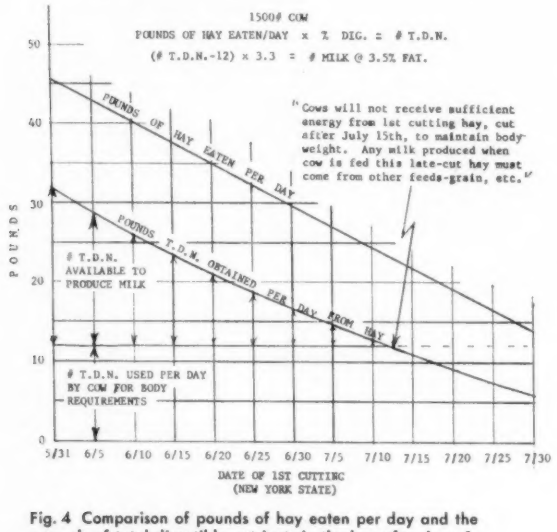

1500# COW
POUNDS OF HAY EATEN/DAY x % DIG. = # T.D.N.
(# T.D.N.-12) x 3.3 = # MILK @ 3.5% FAT.
POUNDS OF HAY EATEN PER DAY
POUNDS T.D.N. OBTAINED PER DAY FROM HAY
T.D.N. AVAILABLE TO PRODUCE MILK
T.D.N. USED PER DAY BY COW FOR BODY REQUIREMENTS
" Cows will not receive sufficient energy from 1st cutting hay, cut after July 15th, to maintain body weight. Any milk produced when cow is fed this late-cut hay must come from other feeds-grain, etc."
POUNDS
0
10
20
30
40
50
5/31 6/5 6/10 6/15 6/20 6/25 6/30 7/5 7/10 7/15 7/20 7/25 7/30
DATE OF 1ST CUTTING
(NEW YORK STATE)

Fig. 4 Comparison of pounds of hay eaten per day and the pounds of total digestible nutrients in the hay after June 1

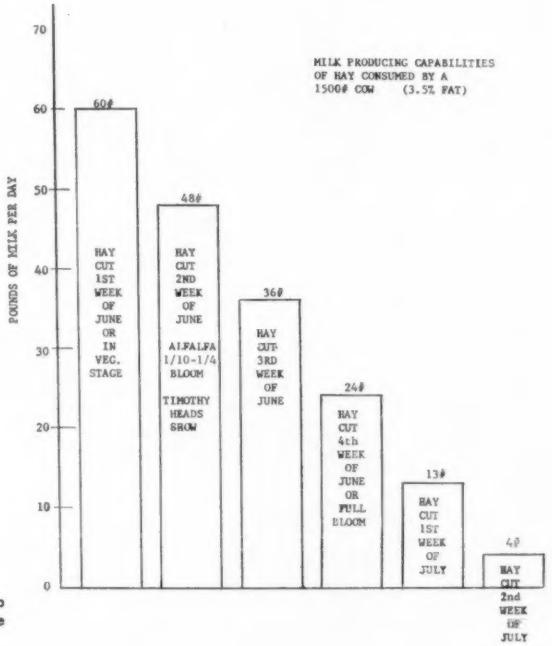

MILK PRODUCING CAPABILITIES OF HAY CONSUMED BY A 1500# COW (3.5% FAT)
POUNDS OF MILK PER DAY
0
10
20
30
40
50
60
70
60# HAY CUT 1ST WEEK OF JUNE OR IN VEG. STAGE
48# HAY CUT 2ND WEEK OF JUNE ALFALFA 1/10-1/4 BLOOM TIMOTHY HEADS SHOW
36# HAY CUT 3RD WEEK OF JUNE
24# HAY CUT 4th WEEK OF JUNE OR FULL BLOOM
13# HAY CUT 1ST WEEK OF JULY
4# HAY CUT 2nd WEEK OF JULY

Fig. 5 Milk-producing capabilities of hay consumed by a 1500-lb cow on hay cut during each of the four weeks of June and the first two weeks of July

. . . Four-Wheel Braking

(Continued from page 747)

Drawbar load was measured in order that braking force could be determined. Traction coefficient was recorded to compare weight transfer for different values of μ.

With the application of front and four-wheel brakes, it can be expected that the tractor will have less tendency to jackknife with the trailing load than with rear-wheel braking.

Tests were conducted on a downward sloping grade, both on sod and on a blacktop road surface. The trailing load (tractor) was used to push the test tractor down the grade at a uniform rate of speed. Four tests were run for each type of braking. The following figures show averages of the four tests:

Drawbar load (lb push)	Brakes applied
710	Front
1050	Rear
2175	4 Wheel

μ=0.65 (sod) Drawbar height=23 in. Percent grade=16.7

Figure 6. Drawbar Loads When Braking with Trailing Load

Since the actual braking force from the front was 1470 lb (Fig. 7) and calculations using the overall μ give 1180 lb, the traction coefficient must, therefore, be greater for the type of tire tread on front:

$$\mu_f = 1470 \text{ lb}/1805 \text{ lb} = 0.81$$

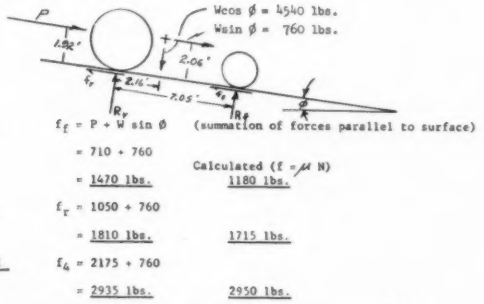
This is a closer value of the traction coefficient for the front tires. However, on the sod track μ would vary along its length.

Braking with a Trailing Load at High Speeds

The only variable recorded in tests with a trailing load at high speeds was the type of brakes used. The tests were conducted on sod in order that longer slides could be obtained, resulting in lower μ value. The test tractor would tow the trailing load at full throttle in high gear (approximately 16 mph) down the grade. The load tractor's brakes were applied only if necessary for test tractor stability.

Three types of brake application were tried. It was found that with the front wheels locked, the tractor would slide in a straight line all the way to the bottom of the hill nearly 200 ft. However, when only the rear brakes were applied, the vehicle would jackknife in 5 to 10 ft. Had the trailing tractor not been braked, the experimental tractor would have overturned.

When all four wheels were braked, the vehicles stopped in a short distance and characteristic slides were difficult to obtain. Tractors tended to jackknife in four-wheel braking, but with less tendency than when only the rear wheels were braked. The tractor, in four-wheel braking, tended to slide in a straight line until some outside force was encountered. Torque applied from the trailing load eventually would cause it to jackknife. It must be emphasized here, however, that the braking force in four-wheel braking was much greater (approximately double) than with only the rear brakes applied.



Front: f_f = P + W sin ∅ (summation of forces parallel to surface)
= 710 + 760
= 1470 lbs. Calculated ($f = \mu N$) 1180 lbs.

Rear: f_r = 1050 + 760
= 1810 lbs. 1715 lbs.

4 Wheel f_4 = 2175 + 760
= 2935 lbs. 2950 lbs.

Fig. 7 Braking with trailing load on downward slope

Sliding vs. Impending Slide

In several tests on the blacktop road, the maximum static braking force (impending slip) was recorded.

Brakes applied	Drawbar load (lb, sliding)	Drawbar load (lb, static)	
Front	1270	1845	Excluding
Rear	2450	2460*	Gravity
4 Wheel	4200	4670	Component

*Loose gravel under tire.

Figure 8. Drawbar Loads Indicating Maximum Static Braking Forces

Note that with four wheels holding (static), the total braking force (4,670 lb) was greater than the tractor weight (4,610 lb). This results when static coefficient of traction is greater than the sliding coefficient.

To take advantage of a greater braking force from impending slide as compared to sliding, all brakes must be adjusted so they will apply uniformly. With brakes in good adjustment, a greater braking force was obtained impending slip than during a full slide.

Summary

A series of tests was run to give specific information concerning braking characteristics which may be useful in the design and establishment of effective four-wheel braking systems for tractors in use on hilly farm land.

Four-wheel braking is essential for safe operation of an agricultural tractor on side hill land. In order that a tractor's power and maximum pull be fully utilized for trailing implements on land with a steep grade, the tractor should have a better braking system than those used on present-day models.

From tests conducted with the experimental four-wheel brake tractor, it can be concluded that:

- The sliding end of a four-wheel vehicle tends to lead; therefore, when there is braking only on the front axle, the tractor will continue in a straight line.‡
- The addition of front-wheel brakes will approximately double the maximum braking force obtainable from a tractor, in comparison to rear braking only.
- In many cases, braking with four wheels will eliminate dangerous sliding and jackknifing.
- In general, four-wheel braking will help eliminate potential serious accidents caused by lack of understanding of the operator of the limitations of his machine.

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2 Mansson, G. Braking and stabilities tests for an agricultural tractor, M.S. Thesis, 89 pp., Cornell University, 1958.

3 Perry, C. C. and Lissner, H. R. The strain gage primer, McGraw-Hill, 278 pp., 1955.

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‡This was established in previous tests but applies equally well to tractors.

Buildings Engineered to Farm Needs

Robert S. Speicher
Affiliate ASAE

Functional requirements for almost any farm building can now be served by the wide variety and flexibility of available steel components and assemblies

ONE of the greatest challenges to the agricultural engineering profession lies in farmstead planning. Functional requirements of farm buildings are changing rapidly and must constantly be reviewed, if the farmer is going to increase his labor efficiency and take maximum advantage of labor-saving mechanical devices to lower production costs.

Agriculture in the United States has been changing rapidly in recent years. The rapid mechanization of farms and changes in farming technology have caused farm size to increase and stimulated changes in management, production methods and materials-handling systems. These changes have frequently revealed existing farm buildings to be of the wrong size, inadequately flexible for new uses, or no longer properly located for maximum efficiency. At the same time technological developments, such as automatic feed-handling and confined livestock-production and other systems, such as the loose housing in dairy production, have entered the farm picture to further complicate the adaptability of traditional farm buildings. The one type of building system in use today that could also be called the more nearly perfect building system of tomorrow is the steel building system with its variety of standard sizes, bolted construction and its present flexibility to meet changing agricultural shelter needs.

The steel fabricating industry is providing flexibility, value and sound engineering in prefabricated steel components and assemblies for farm structures to meet farm shelter needs. The most commonly accepted definition of a steel building implies that the building has a steel framework and a steel covering material. But there are modified versions of steel buildings where the major framing members are of steel, and the secondary members, such as the purlins and girts, are of wood. To further define the subject of steel components and assemblies for farm construction, this paper will be confined to steel farm buildings, but will not include such items as steel silos or grain bins. It will include a broad discussion of the general types of steel buildings, how their components are fabricated, as well as basic nomenclature, accessories and applications.

Types of Steel Buildings

Steel farm buildings on the market today are generally classified by the type of steel framework such as:

Rigid frame

(a) Open web, similar to bar joist type construction

(b) Closed web, generally a tapered beam type

Panel frame, assembled in panels and erected in large sections

Steel pole, using the wooden pole building principle with steel materials

Arched rib, or "quonset" style

Frameless arch panel, stressed-skin construction

Sizes of Steel Buildings

Clear span widths vary as to type of building and manufacturer. There are many sizes in the 5 to 40-ft width range, with 28 to 32-ft and 36-ft widths being very common. As the clear span widths get larger, they seem to standardize into 50, 60, 70, 80, 90, 100, and 120-ft widths. Of course, multiple widths are available with interior columns. Length increments are generally governed by the type of steel building but are usually in increments of 2, 4, 12, 16, and 20 ft after a basic length such as two bays has been used. Total length is practically limitless. Sidewall heights again vary by type of building and purpose for which the building is to be used. Generally sidewall heights are available in 6 to 20-ft heights in 2-ft increments (with 8, 10, 12, 14, 16, and 20-ft heights most common). So it can easily be realized that with the variety in types, widths, lengths and heights, there is a *size* of building to fit any need. It is difficult to generalize on the most economical size, as this factor would vary with the particular type of building, the manufacturer and the farmer's needs.

Fabrication of Steel Buildings

Component parts of steel buildings are manufactured in a variety of ways depending upon the steel material being fabricated, the extent of fabrication required and the end product desired. Some of the most commonly used methods are as follows:

Press Brake. Steel sheet material is usually pressed between dies to shape a component part, that is, typical parts such as purlins, girts, and roofing and siding panels.

Shear and Punch. Standard steel shapes or sections, such as bar angles, are cut to length and bolt holes punched into the material.

Shear and Weld. Steel plates and sheets are sheared to proper dimensions and welded into tapered structural shapes or other structural sections as desired.

Roll Forming. Components such as purlins and girts, roofing and siding panels and some major framing members are formed on a continuous rolling operation from steel sheets.

Die Stamping. A pressing type operation used to fabricate steel sheets into a stressed skin or arch panel design. (The panel is very deeply formed.)

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Ohio State University, Columbus, June 1960, on a program arranged by the Farm Structures Division.

The author — ROBERT S. SPEICHER — is development representative, Market Development Division, United States Steel Corp., Pittsburgh, Pa.

Foundations

Several types of concrete foundations, such as concrete piers, floating slab, flush reinforced concrete, or raised wall are used for steel buildings. The choice is usually governed by the intended use of the building and the type of building. Anchor bolts are imbedded in the concrete foundation to anchor the steel-building frames to the foundation. It is most important for the proper erection of steel buildings that foundations be level, square and accurate and that the anchor bolts be properly positioned.

After the foundation requirements are met, the erection of steel buildings vary greatly because of the different types and shapes. This phase of the subject will not be covered in any detail in this paper.

Roofing and Siding Panels

Most every steel-building fabricator has his own roofing and siding-panel pattern. Panels for steel farm buildings are fabricated from galvanized steel sheets from 20 to 28 gauge (0.040 in. to 0.019 in.) with 26 gauge being most common. Panels are ribbed to provide added strength, rain-carrying capacity and an attractive appearance. These panels vary in width from 16 in. to 3 ft and in lengths up to 32 ft long. Every effort is made to eliminate unnecessary panel end laps by using the longest sheet possible.

During the last few years factory-color-coated galvanized steel panels have become available (prepainted sheets with baked on vinyl aluminum and vinyl based coatings). Factory-painted roofing and siding panels should become increasingly popular on steel farm buildings for their very striking appearance. Roofing and siding panels are attached to the steel framing with cadmium-plated bolts or screws with neoprene washers. Extra precautions are taken to seal the panels from the weather by the use of mastics, either applied at the factory or caulked during field erection. Often asphalt closure strips are used around window and door openings and at the eave line if additional weather tightness is desired and not secured by flashings or miter-cut panels.

Accessories

Complete lines of accessories for steel buildings are provided by most fabricators. They include doors (overhead, single or double sliding, service or personnel), windows, ventilators, louvers, insulation and translucent plastic light panels to fit the roofing and siding sheet patterns. Canopies and lean-tos are also made available to supplement standard steel buildings. Insulation materials include the rigid board, vapor-sealed blankets and sprayed-on vermiculite. Some fabricators also provide grain drying and conveying systems adapted to their steel buildings.

Agricultural Applications of Steel Buildings

Steel farm buildings can be classified as basic-shelter or general-purpose applications and special-purpose applications. Basic-shelter applications include machine sheds, bulk storage of feed and crops and livestock housing. Special-purpose applications include controlled environment for livestock such as stanchion dairy barns, hog farrowing and finishing houses and poultry houses. Fruit and vegetable storages many times require a controlled atmosphere. Grain storage buildings also require special attention for added structural strength due to the high lateral pressures on the sidewalls and for conditioning equipment for cooling, aeration and in-storage drying. The special-purpose applications generally involve specific insulation and ventilation problems.

Summary

With the large variety and flexibility of the steel components and assemblies provided by the steel fabricating industry, there is a type and size of steel building to serve almost any functional requirement for farm structures. Steel is an excellent engineering material. Its structural performance is easily predicted, it withstands both compression and tension, and it is relatively low in price. Steel does not burn or support combustion in ordinary building fires, making it a superior structural and covering material.

The trend in farm-building construction seems to be more toward contract building and less do-it-yourself construction on the farmer's part for major farm structures. This allows the farmer to compare the values of the various types of construction to fulfill his requirements, on the basis of a completed structure on his place of business at a given time. He therefore is not comparing the price of only the materials of one building system with the price of the completely erected building.

Pre-engineered steel buildings are designed by professional engineers for maximum efficient use of materials, and building components are fabricated for rapid field erection. They are flexible in dimension and use, easily expanded or rearranged in keeping with the farmer's needs. All bolted construction permits complete dismantling and salvage of a complete building if moving is necessary. Clear-span construction enables the efficient use of power equipment.

Today's farmer may obtain a complete "package" installation from his local steel-building builder. Many times an entire building system, including a materials-handling system, may be had by dealing with one individual. The steel-building builder also serves the farmer as an architect and structural engineer, having many of these special services available from the building manufacturer. Finance plans are also available through the steel building builders, Through this distribution channel the farmer will find his steel-building builder has time to advise the farmer on site planning and building layout, as the structure portion is already predesigned and fabricated.

Steel building fabricators have found the agricultural engineering profession most valuable in developing and marketing their building products for farm structures. Many of the manufacturers have professional agricultural engineers on their staffs and others obtain the services of consulting agricultural engineers. These agricultural engineers must transmit the functional requirements of the many systems of agricultural housing to their structural design engineers and production engineers in order that a very useful and saleable building product may be produced.

One of the greatest services the public service agricultural engineer can perform for the American farmer is to continually conduct research, review, revise and report the *functional* requirements of the various types of farm shelters needed. Industry is ready and qualified to supply the farm structures, that will satisfy these requirements.

Fig. 1 Hydroseeder sprays seeds and fertilizer mixed with water. This bantam seeder sprays 500 gallons of mixture covering one acre in about 15 minutes

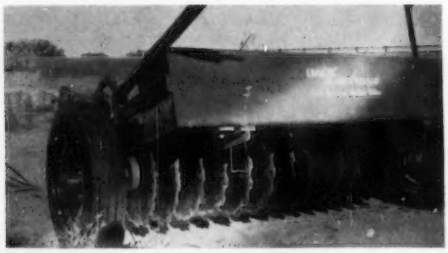
Fig. 2 Shredding-blowing type mulch spreader in operation. Liquid asphalt is sprayed directly into the mulch stream for complete mixing

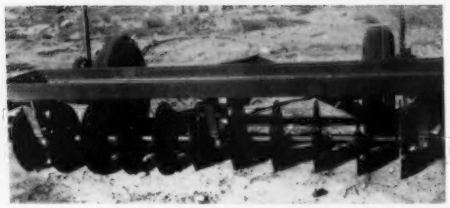
Anchoring Vegetative Mulches

W. S. Chepil, N. P. Woodruff, F. H. Siddoway, and Leon Lyles

Member ASAE *Assoc. Member ASAE*

Five Implements Were Tested





THE Army, Navy, Air Force, highway departments, and other agencies continually encounter the problem of wind erosion of freshly tilled, bare ground. Mulching with crop residues before or after seeding to grass has become a common practice to stabilize soil.

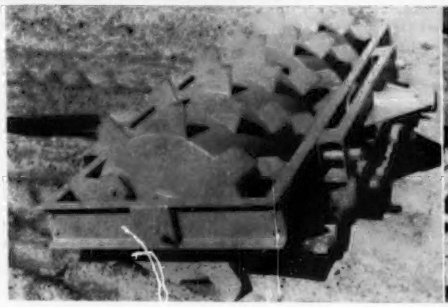
In many cases Navy installations are built along coastlines and on sandblown islands where immediate sand stabilization during construction periods is necessary. Under

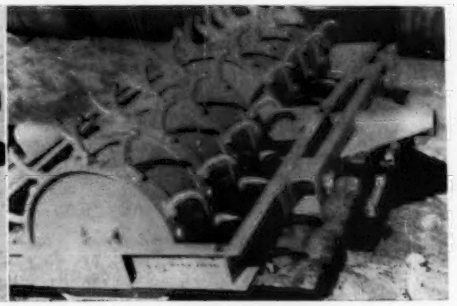
Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Ohio State University, Columbus, June 1960, on a program arranged by the Soil Erosion Group, Soil and Water Division, as Contribution No. 700 of Kansas Agricultural Experiment Station, Department of Agronomy, Manhattan, Kans., in cooperation with Bureau of Yards and Docks, U. S. Department of the Navy.

The authors — W. S. CHEPIL, N. P. WOODRUFF, F. H. SIDDOWAY and LEON LYLES are, respectively, soil scientist, agricultural engineer, soil scientist, and agricultural engineer, Western Soil and Water Management Research Branch (SWCRD, ARS) USDA, Manhattan, Kans.

Acknowledgment: The authors wish to make acknowledgment to the State Highway Commission of Kansas, Finn Equipment Co., Hutchinson Foundry and Steel Co., Independent Manufacturing Co., Miller Weeder Co., Morningstar-Paisley, Inc., and American Bitumuls and Asphalt Co. for generous assistance and use of land, equipment, and supplies. C. L. Hamilton and L. B. Bassett of the U. S. Department of the Navy and J. R. Johnston, J. S. Robins, and the late A. W. Zingg of the Agricultural Research Service participated actively in organizing and inspecting the research work. The work was financed by the Department of the Navy.

For detailed description of test procedures and a discussion of results please request ASAE Paper No. 60-207 from ASAE, 420 Main St., St. Joseph, Mich. (Price, 50¢ per copy or use ASAE member order form.)





Figs. 3-7 Five types of mechanical packers were tested. Shown above are *(top)* cutaway rolling disk packer with ¼-in. thick disks spaced 4 in. apart; *(center)* smooth rolling disk packer with disks spaced 8 in. apart; *(bottom)* V-tread rolling wheel packer with 1-in. thick wheels spaced 5 in., apart. Shown at right are *(left)* plate punch packer with ⅜-in. plates, 5 in. maximum length welded to a rolling drum 21 in. in diameter. The drum can be filled with water for required depth of penetration; and *(right)* L-rod punch packer with rods ⅞-in. diameter and 5 in. overall length, bent 90 deg., 1⅝ in. from the loose end

such conditions immediate stabilization such as by mulching is essential before or instead of a grass cover.* Information is needed as to whether the same methods of anchoring mulch are applicable for extremely sandy areas as for finer textured soils.

A project was conducted to obtain information on the most effective methods and equipment to anchor vegetative mulches to stabilize soils against wind erosion. A plot of land was seeded to grass and fertilized. Various quantities, of mulch in the form of hauled-in prairie hay and wheat straw were applied uniformly on the surface using a blower type mulch spreader. Five different types of mechanical packers and various quantities of asphalt emulsion and cutback were used to anchor the mulch (Figs. 3-7).

During the tests the best implement for anchoring mulch was a disk packer, preferably with cutaway disks spaced not more than 4 in. apart if penetration and clogging are not a problem, as on dune sand. Where penetration or clogging is a problem, disks have to be spaced about 8 in. apart for packing once, or 12 in. apart for packing once in one direction and then once in the direction perpendicular to the first packing to form a grid system of rows. The 8-in. spacing of disks does not produce a grid system because virtually all the mulch is pulled into the rows and punched into the ground and the first time over. To improve the effectiveness of packing, two possible courses remain: *(a)* space the disks as close together as possible but not so close as to prevent proper penetration or to cause clogging of the disks, and *(b)* space the disks at least 12 in. apart, pack, then pack again at right angles to the direction of the first packing. A choice of two packers with about 4 and 12-in. disk spacings is desirable. However, if only a single packer is available and soil texture and hardness of ground are variable, compromising by spacing the disks about 8 in. apart is probably the best alternative. Changing the spacing of the disks to suit different conditions is a tedious task.

The disks should penetrate at least 2 in. but not more than 3 in. for proper anchorage and effectiveness. If ground is too hard for disks to penetrate to proper depth, it should be loosened by tillage to the depth of desired disk penetration.

The average quantity of well anchored (packed) mulch required for adequate protection against equivalent 85-mph wind appears to be as follows:

6000 lb per acre of wheat straw on most erodible dune sand.

5000 lb per acre of prairie hay on most erodible dune sand.

5000 lb per acre wheat straw on less erodible soils.

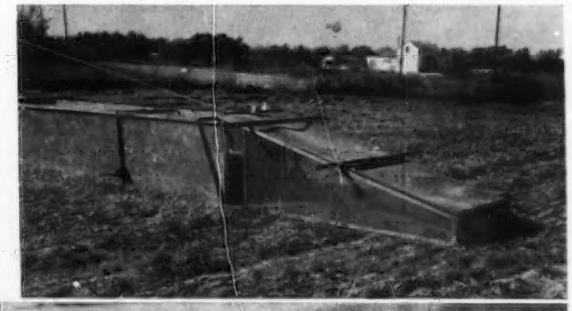
4000 lb per acre of prairie hay on less erodible soils.

Where a packer cannot be used, such as on steep dunes or construction slopes, liquid asphalt mixed with the mulch can be applied. For mulch anchored with asphalt on smooth ground and any degree of soil erodibility, including dune sand, the following treatment appears to be fully effective against strong winds: a uniform cover of 4000 lb per acre of prairie hay or 5000 to 6000 lb per acre of wheat straw mixed thoroughly with a fine spray of at least 300 gal per ton (600 gal per acre) of rapid-curing-asphalt cutback (RC) or emulsion for hay or with at least 400-gal per ton (900 to 1000 gal per acre) of rapid-curing-asphalt cutback or emulsion for straw.

For mulch anchored with asphalt on moderately rough ground of any degree of erodibility, the same quantity of mulch as for smooth ground can be used but the quantity of asphalt can be reduced to 200 gal per ton (400 gal per

(Continued on page 759)

*Jones, Gordon H. Problems on airfield pavement shoulders in arid and semiarid regions. Paper presented at American Society of Agronomy meeting, Lafayette, Ind., August 1958.



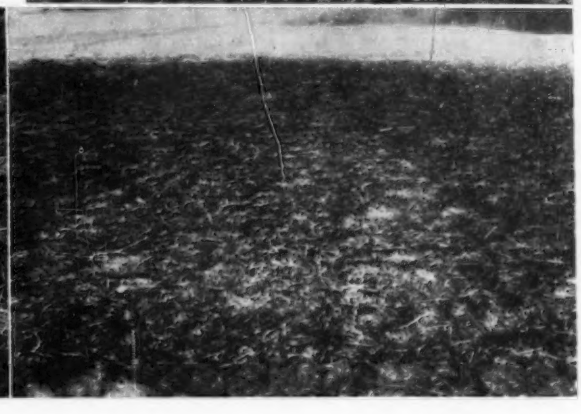


Fig. 8 *(Right)* **Leeward end of wind tunnel was used as mulch catcher. A soil catcher (not shown) fits the mouth of the mulch catcher • Fig. 9** *(Lower left)* **4000 lb per acre of wheat straw anchored with disk packer with 8-in. spacing of disks. Dune sand was completely protected with 85 mph wind blowing at right angles to rows • Fig. 10** *(Lower right)* **4000 lb per acre of wheat straw with 400 gal per acre of rapid-curing-asphalt emulsion gave almost complete protection from strong winds on dune sand, as shown in the foreground. The background was not treated**

INSTRUMENT NEWS

Radiation-Sensitive Infrared Brooder Control

G. M. White and J. G. Taylor
Assoc. Member ASAE *Member ASAE*

TO MAINTAIN a comfortable environment in the brooder without any unnecessary expenditure of energy is the primary requirement of any brooder control. In most chick brooders the energy supplied to the brooder is directly related to the brooder air temperature since thermostats are primarily sensitive to air temperature. In infrared brooders, however, air temperature alone does not determine when optimum brooding conditions exist. This is because the infrared energy from the brooder lamps is transmitted to the chickens under the brooder without actually heating the air through which it passes; therefore, the chickens can be comfortable at somewhat lower air temperatures than those found to be necessary in other types of brooders. If the brooder air temperature cannot be used alone as an indication of the heat received by the chickens beneath an infrared brooder, then the ordinary thermostat possesses definite disadvantages as an infrared brooder control.

A control has been developed at Purdue University to regulate automatically the energy level in infrared chicken brooders. This control is responsive to radiation and convection as well as to the brooder air temperature.

Sensing Element Description

Chicks under a brooder normally lose heat to their environment, since their body temperature is generally higher than that of their surroundings. The function of a brooder control is to regulate the rate of loss by controlling the environmental temperature or by supplying radiant energy necessary for chicken comfort from such sources as infrared lamps.

The new control has a 4-in. globe painted flat black which is used to simulate the reactions of baby chicks beneath a brooder. This globe is located under the brooder lamps just above the litter. Its internal temperature is regulated thermostatically near the body temperature of a chicken (1)* and the rate of heat transfer from this sensing element is presumed to be affected by environmental conditions in a manner similar to that from a chicken.

The heat energy necessary to maintain the globe temperature at the desired set point is derived from two sources — some is supplied continuously through an electrical resistance element mounted within the sphere and the balance is supplied intermittently by infrared brooding lamps.

The component of heat supplied by the internal heater is increased with chick age. Thus the globe will maintain its internal temperature without any additional radiant energy from the lamps in progressively cooler surroundings. This is equivalent to the reduction in brooding temperature with chick age in conventional heated-air brooders. Suitable heater settings for different aged chicks have been determined through tests based on accepted brooding temperatures (2, 3). A rheostat and a calibrated voltmeter are used to adjust this input with chick age.

Whenever the ambient temperature in the brooder drops below optimum brooding temperature the heat from the internal heater is insufficient to maintain the globe temperature at the control point. Additional energy must be supplied to the globe from the infrared brooder lamps to maintain the level of chick comfort beneath the brooder.

Thermostatic Control Circuit

The temperature inside the sensing element is controlled by using a d-c Wheatstone bridge circuit containing a Western Electric, type 14B, thermistor sensing element. The thermistor, which is a temperature sensitive resistor having a high negative temperature coefficient of resistivity, is located near the center of the control globe as shown in Fig. 1. The output of the bridge circuit is proportional to the deviation of the globe temperature from the control point which is set by means of an adjustable rheostat (R_3) in one leg of the bridge (Fig. 2).

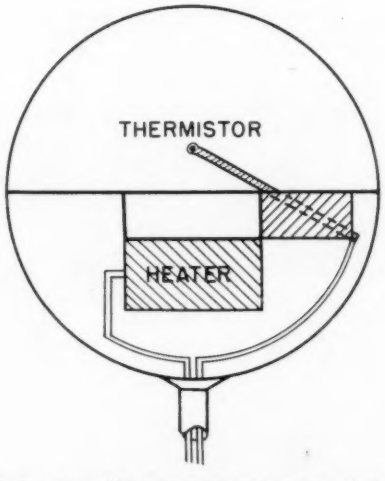


Fig. 1 Location of heater and thermistor in control globe

An Instrument News Contribution. Articles on agricultural applications of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

The authors — G. M. WHITE and J. G. TAYLOR — are, respectively, assistant professor, Purdue University, Lafayette, Ind., and agricultural engineer (deceased), Agricultural Research Service, USDA, Purdue University, Lafayette, Ind.

*Numbers in parentheses refer to the appended references.

To control the globe temperature the output of the bridge circuit is amplified by means of a transistor amplifier using a Raytheon, type CK722, transistor. This amplifier enables the bridge output to actuate a sensitive relay and thereby control the radiant energy input from the brooder lamps.

Proportional-Time Cycle

When the control is in operation a considerable transfer lag occurs between the time the heat is added by the brooder lamps and when it is sensed by the thermistor sensing element inside the globe. To reduce the effect of this lag on the accuracy of the temperature control within the globe, a proportional-time cycle control has been used in conjunction with the thermistor bridge. This feature evens out the input of the brooder lamps and thereby lessens the influence of transfer lag on temperature control within the sensing globe.

The proportional-time cycle control is produced as shown in Fig. 2 by using a low resistance motor-driven rheostat (R_4) in series with the main adjusting rheostat of the bridge. Rotation of this variable resistor continually cycles the balance point of the bridge over a range of about 3F at a frequency of 4 cycles per minute. This arrangement in effect, sweeps the thermostatic setting of the control back and forth across a 3-deg band every 15 sec. Thus, when the sensing sphere's temperature is within this proportional band the lamps are turned on for a portion of each cycle, with the length of these "on" periods being proportional to the deviation of the globe temperature from the controller set point. Above the 3-deg band the lamps are off continuously, and below this range they are on continuously.

The proportional-time cycle control, in addition to reducing the amount of controlled-temperature overshoot beyond the set point, also increases chicken comfort beneath the brooder by shortening the periods during which the lamps are off. Long periods without radiant heat in an infrared brooder tend to cause chicken discomfort due to chilling.

Control Operation

In an actual chicken brooding installation the control sphere is located beneath the brooder lamps just above the litter. This enables the globe temperature to be used as an indication of how well the control is supplying the energy needs of the baby chicks.

In any one brooder the setting of the globe temperature depends on such factors as: *(a)* the location of the globe beneath the brooder; *(b)* the infrared energy pattern of the brooder lamps; and *(c)* the chick energy requirements based on chick breed, health, etc. It is therefore recommended that the globe be placed in an area of maximum infrared energy and that its temperature be adjusted to obtain chick comfort at the beginning of the brooding period. After this initial adjustment, it should be necessary to adjust only the globe heater input with chick age.

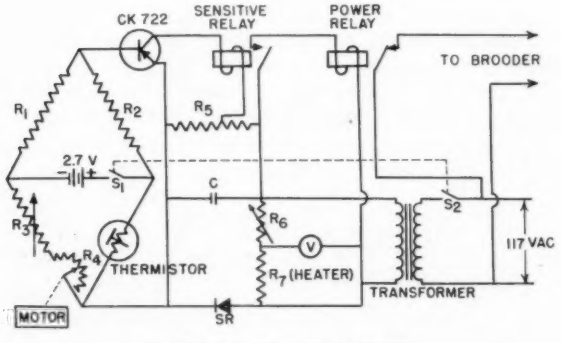


Fig. 2 Control circuit diagram

Summary and Evaluation

The radiation-sensitive infrared shows promise of practical application in chicken brooding installations as indicated by its satisfactory performance in an actual brooding test at Purdue University. As yet, no comparison tests have been made with conventional brooder controls, and therefore, no definite conclusions can be drawn regarding its actual utility. It is felt, however, that the following comparative statements can be made based on the observations and results gained from the preliminary analysis and testing of the control:

- In addition to being responsive to the brooder air temperature, the control is responsive to radiation and convection. In contrast, most conventional brooder controls respond primarily to brooder air temperature.
- The energy supplied to chickens with the control is not affected by changing lamp characteristics; whereas, the energy supplied would be affected by those controls not directly sensing radiant energy from the lamps.
- The expected life of the control is not known, but due to its complexity it would appear that its life would be shorter and its frequency of repair higher than most brooder controls.
- The amount of energy supplied to the chickens can be adjusted easier than it can by most conventional controls. This is done by adjusting the heater voltage for each chicken age with a rheostat. Another adjustment in the sphere's control temperature can be made to compensate for changing energy requirements.
- Proportional time cycling offers definite advantages over wafer snap action thermostats in that the frequency of the "on-off" cycles can be increased to reduce the tendency for the chicks to chill due to long "off" periods. This also allows the control to function more accurately since it reduces the amount of overshoot which occurs in the globe temperature.
- On a power consumption basis several factors indicate that the control should compare favorably with conventional types. It takes into account any solar energy received beneath the brooder, and secondly, it operates on radiant energy from the brooder lamps; thereby making it unnecessary to heat up the air under the brooder as required with most ordinary thermostats.
- Due to the cost of the component parts of the control it appears that it is more expensive than the majority of the individual brooder controls in use today. This will probably restrict its use to large brooding installations where the control globe can be placed under one brooder and used to control several units with similar energy requirements.

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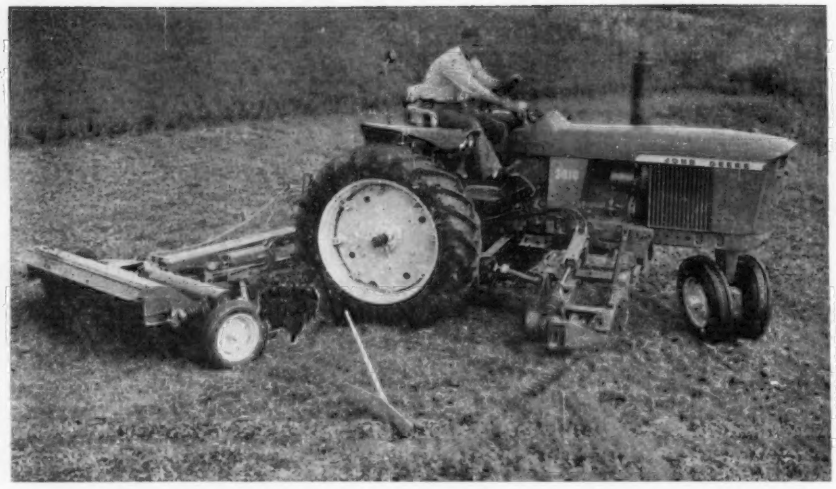


Available in four power sizes is the new line of tractors introduced by Deere and Co. as its "New Generation of Power"—a complete departure from previous design

Introduces "NEW GENERATION OF POWER"

SIX years ago John Deere agricultural engineers heard first news of a plan that would result in a radical departure from previous tractor design. They were presented with an engineering program that actually turned out to be the largest such effort undertaken by the company in its 123-year history. Contrary to usual practice — that of effecting a gradual transition or evolution in engineering and design — the desired results necessitated that the entire line of tractors be replaced with a completely new concept.

As a result, a new line of farm tractors has been introduced and traditional features identified with John Deere tractors since the early 1920's were discontinued. The 2-cylinder engine and its familiar "putt-putt" sound has been replaced with variable-speed 4 and 6-cylinder engines ranging from 35 to 80 hp. Also the new engines no longer are mounted horizontally with the crankshaft parallel to the rear axle thereby eliminating a right-angle drive in the power train. For the first time since World War II the Otto cycle distillate-burning engine is no longer available as optional. Such a departure from past design naturally attracts much interest in the industry.

Engine

The largest model in the new line is designated the 4010 series and is equipped with an 80-hp, 6-cylinder engine. The second largest series is the 3010 which is equipped with a 4-cylinder engine rated at 55 hp. The two smaller sizes, designated the 2010 rated at 45 hp and the 1010 rated at 35 hp, have 4-cylinder engines and are available in both wheel and industrial crawler type chassis. Horsepower values are obtained at the PTO drive — 2200 rpm engine speed for the two larger sizes and 2500 rpm engine speed for the two smaller sizes. LP-Gas, gasoline and diesel engines will be available for the three larger sizes. Diesel and gasoline engines will be furnished for the 1010 series.

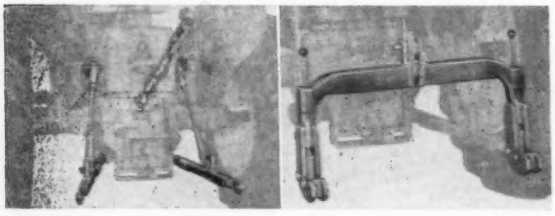
Transmission

The transmission, which is controlled by a dash-mounted lever, shifts collars rather than gears which remain in constant mesh. Within any of the four gear ranges, the transmission can be shifted on the go. The three larger series have eight forward and three reverse gear ratios providing travel speeds from 1.52 to 14.26 mph. The transmission can also be shifted between forward and reverse without stopping tractor travel, providing the same advantage as a built-in direction reverser.

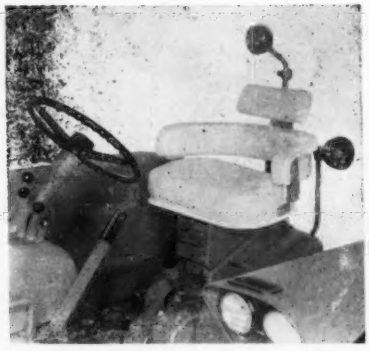
Hydraulic System

The new hydraulic system used in the two larger tractor models consists of the closed-center constant pressure type. The transmission and differential case serves as a common reservoir of oil for hydraulics, power steering, power brakes, transmission, and differential. A variable-displacement pump originally developed for aircraft use, has been tailored to farm tractor use. This pump consists of eight pistons positioned radially around a drive shaft and goes off-stroke when there is no power demand. It provides up to 18 gpm at rated pressure of 2000 psi immediately upon a demand from any of the hydraulic functions.

A selective hitch response provides a choice of load, depth, or load-and-depth control of 3-point hitch equip-



At left is the new universal 3-point hitch and at right is a new quick coupler designed to enable mounting and demounting of equipment from the tractor seat



(Left) Industrial designer, Henry Dreyfuss, and Dr. Janet G. Travell, an authority on posture seating, were consulted in the design of three-cushion seat for operator comfort. It can be adjusted to operator's physical proportions as well as weight

(Right) Two-speed PTO's (540 and 1000-rpm) are interchangeable by changing stub shafts

ment. A shift from one response to another is made by moving a lever alongside the seat. The response for load or load-and-depth control is done automatically.

Power Take-Off

Two stub splines permit use of the same tractor for power-driven equipment built for the 540-rpm speed or for the new standard of 1000 rpm. A 21-tooth version provides 1000-rpm speed while a 6-tooth spline is used for the lower speed. This feature is available for all four tractor models. On the two larger models, a 1000-rpm front PTO prepares the tractors for new machines and PTO applications.

. . . Anchoring Vegetative Mulches

(Continued from page 755)

Fig. 11 A slope harrow composed of rotating chain to which 15-in. rods are welded is used for leveling small rills on 1:3 slope. Rotating weight at the bottom keeps harrow from pulling up slope

acre) for hay and 300 gal per ton (700 to 900 gal per acre) for straw.

Complete effectiveness of mulching and anchoring the mulch without packing apparently consists of *(a)* complete cover of the ground with the mulch, and *(b)* adequate anchorage of the individual pieces of the mulch to the ground or to each other. On loose sand, little anchorage of the mulch to the ground occurs so that the stability of the mulch cover depends on the roughness of the ground and on the strength with which the individual pieces of the mulch are held together by the cementing agent. The ground roughness should not exceed 4 in. in height.

Ground too rough appears to be as bad as too smooth. On ground too rough, mulch falls too much on one side of the roughness so that when wind is reversed, mulch may roll into the depressions and consequent soil loss may occur. Land should be just rough enough to give good mulch anchorage but the roughnesses should be small enough so that the mulch will produce a continuous cover.

Small weeds or other plants, dead or alive, are important in holding down the mulch. It is better to let some weeds stand, especially on sand, than destroy them by tillage prior to mulching.

Whether the soil is highly erodible or not, the quantity of mulch and asphalt required for complete protection against wind appears to be about the same. The objective should be for complete cover of the surface no matter how erodible it is. Of course greater care must be exercised on sand than on less erodible soil to see that no weak spots exist in the mulch cover.

It is important that the mulch be spread uniformly as with a blower type spreader. It is impossible to hand-spread as uniformly or, in America, as cheaply as with a suitable mechanical spreader.

It is important that the liquid asphalt be spread uniformly with the mulch. Intermittent injections of asphalt into a stream of mulch when the blower is used are not entirely satisfactory. Rather than control the quantity of asphalt that way, it is preferable to reduce the size of the asphalt nozzle and apply the asphalt continuously into the stream of mulch. The asphalt spray should be as fine as possible.

Mechanized Agriculture Course Survey

THE Agricultural Mechanization Club at the University of Missouri, composed of students enrolled in the college of agriculture and majoring in the applied phases of agricultural engineering, conducted a survey of 39 agricultural engineering departments in the United States to determine the status of curriculum and name of course.

A summary of the results are as follows:

1 Nineteen departments offered courses for students in the college of agriculture but they did not have a curriculum.

2 Twenty departments did have a curriculum for these students. Curriculum name and number of departments using that name are:

	Dept.		Dept.
Mechanized Agriculture	7	Applied Agricultural Engineering	1
Agricultural Mechanics	3	Agr. Engineering Technology	1
Agricultural Mechanization	2	Agricultural Equipment Science	1
Farm Equip. Management	1	Mech. Technology in Agriculture	1
Farm Mechanics	1	Farm Equipment Merchandising	1

3 In four departments these students have organized a club separate from the ASAE Student Branch. The names of these clubs are:

Society of Mechanized Agriculture
Farm Equipment Management and Sales Club
Agricultural Mechanization Club
Agricultural Engineering Club (Technology Majors).

USA and USSR Farm Mechanization—A Comparison

Karl D. Butler
Affiliate ASAE

SINCE their trip to Russia in 1958, six ASAE members comprising the USA farm mechanization delegation, as part of the large USA-USSR cultural and scientific exchange program, have been asked these questions: How highly mechanized is Russian agriculture?; just what is the status of their farm mechanization development compared with that of the United States? The following paragraphs, together with Tables 1 and 2, will indicate the comparative farm-equipment strength of the two countries.

Today the USSR boasts millions of tractors and an imposing array of increasingly modern power-driven and trail-behind farm equipment. Plowing is done largely with heavy tractors, and tractor-pulled or self-propelled swathers and combines are used in harvesting virtually all of Russia's vast wheat and small grain crops. Power-drawn grain drills sow most of the grain.

By contrast, the hard physical labor, often supplied by women, required to handle wheat, sugar beets, potatoes, silage and other crops is almost beyond imagination of the average American. Nearly all their haying is done by hand.

It is difficult to make an accurate comparison of manpower used on farms in the United States with that in the USSR. Figures obtained in Russia were inconsistent, but it has been estimated that Soviet agriculture has one worker for about each 15 acres of cropland, compared to one worker for each 60 acres of cropland in the United States. The much greater farm mechanization in the USA is the dominant factor in the vast difference in average manpower in the two countries.

The best figures obtainable indicate that the ratio of labor productivity on farms in the USSR as compared with the USA is about six-to-one, which is an even wider ratio than the four-to-one based on cropland per worker. Involved in this is the fact, based on figures given us, that Russia has about one tractor to each 400 acres of cropland, whereas we have one tractor for each 80 to 100 acres.

The Russians claim their tractors are used on the average of about 1,000 hours per year compared to about 400 hours in this country, and that this proves our tractor use is inefficient. This argument scarcely holds water when one considers that in this country each farm worker produces enough for 23 other people and that each Russian only produces enough for three or four others.

From what was observed in Russia, it should be possible for them to cut down their farm labor force of which more than 60 percent are women. They admit that there are too many people on the land in Russia.

Paper prepared expressly for publication in AGRICULTURAL ENGINEERING.

The author—KARL D. BUTLER—is farm counselor, Avco Corp., Ithaca, N. Y.

A report of the trip to Russia by the farm mechanization delegation was carried in the March, 1959, issue. ASAE members in addition to the author included: Lloyd W. Hurlbut (current ASAE president), University of Nebraska; Walter M. Carleton, AERD, ARS, USDA, Beltsville, Md.; Arthur W. Cooper, National Tillage Machinery Research Laboratory, USDA, Auburn, Ala.; Carl W. Hall, Michigan State University; and Wayne H. Worthington, formerly John Deere Tractor Research and Development Center, Waterloo, Iowa.

TABLE 1. SELECTED FARM EQUIPMENT INVENTORY

	Approx. USSR end of 1958	USDA estimate for USA July 1, 1958
Tractors	1,000,000* (about 52 percent crawlers)	4,500,000 (79 percent wheel type)
Trucks on farms	660,000	3,030,000
Grain combines	500,000†	1,050,000
Corn pickers and corn forage harvesters	170,000	750,000
Field forage harvesters	———	260,000
Sugar beet harvesters	30,000	———‡
Cotton pickers	26,000	20,100‖
Cotton strippers	———	23,900‖
Balers	2,000	600,000
Mowers	299,000§	1,615,000 (pto) 805,000 (ground driven)
Rakes	78,000§	1,400,000
Plows	718,000‖	2,990,000
Planting drills	829,000‖	1,535,000
Corn and cotton planters	———	2,248,000
Cultivators	616,000§	3,000,000‖
Manure spreaders	nil	1,540,000

*Official figure, but data from various sources indicate that about 600,000 would be more accurate.

†Official figure, but checking indicates 318,000 would be more accurate.

‡Because of so few producers in the USA, actual figures are not available.

§End of 1955.

‖End of 1956.

TABLE 2. SELECTED FARM EQUIPMENT PRODUCTION (1957)

	USSR	USA
Trucks	126,000	1,083,670
Tractors	145,000 (actual numbers* at capacity)	233,000 (about 50 percent of capacity)
Combines	131,000	44,700
Corn pickers and corn forage harvesters	51,000 (both)	40,000 (pickers) 18,300 (harvesters)
Sugar beet harvesters	8,600	1,600
Mowers	46,000	86,200
Plows	128,000	147,400
Planting drills	278,000	26,100
Cultivators	208,000	102,500

*In terms of 15 hp, they produced 204,000.

Some observers feel that the Soviets possess adequate tractor power in spite of their poor comparison with the USA. Although they claim 1.7 million tractors in terms of 15 hp, they admit that there would actually be about 600,000 individual tractors in terms of 30 hp. We are told that 52 percent of these are crawlers, but they are moving more toward wheel-type tractors.

There is no question but that much of the standard farm equipment in the USSR has been copied from other countries. However, the Soviets are now moving ahead with original designs, and some of their new equipment looks very interesting.

Even though great progress toward farm mechanization has been made in Russia in recent years, Soviet agriculture today falls far short of being highly mechanized or even reasonably modern when compared to what has been accomplished in capitalistic United States.

Compared with the United States, the Soviets are in their infancy in their efforts to bring together the various farm operations into highly systemized, coordinated, power-mechanized, efficient units.

Khrushchev's avowed aim is to surpass us in the production of meat, milk and eggs. In 1959, Russia produced about one-fourteenth as much corn for grain as the United States. In spite of Stalin's efforts to expand agricultural production, he left the legacy of a weak, poorly managed agriculture. Khrushchev is struggling with this dilemma as one of the top problems of the USSR. Little wonder he wanted to see how we do it in corn-bulging Iowa.

In view of the difficulty the Russians have with corn production, due to their geographic location, lack of abundant good soil, and short-growing seasons, their Achilles' heel is agriculture, particularly animal agriculture.

. . . Instrument News

(Continued from page 757)

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1 King, J. O. L. The body temperature of chicks during the first 14 days of life. The British Veterinary Journal, vol. 112, no. 4, p. 155, April 1956.

2 Barott, H. G. and Pringle, Emma M. Effect of environment on growth and feed and water consumption of chickens (II) — The effect of temperature and humidity of environment during the first eighteen days after hatch. Journal of Nutrition, vol. 37, no. 1, pp. 153-162, January 1949.

3 Barott, H. G. and Pringle, Emma M. Effect of environment on growth and feed and water consumption of chickens (III) — The effect of temperature of environment during the period from eighteen to thirty-two days of age, Journal of Nutrition, vol. 41, no. 1, pp. 25-30, May 1950.

Authors Clarify Stand on Tile Drain Spacing

TO THE EDITOR:

THE following comments pertain to a paper entitled, "Criteria for Tile Drain Spacings in Artesian Areas" by C. Argyriadis and James N. Luthin, Soil and Water edition of Transactions of the ASAE 3:1:87, 89, 1960.

Although no one has raised the question, reference should have been made to important articles by Kirkham (3, 4, 5)*, Farr and Gardner (2), van Deemter (9), Muskat (7), and Engelund (1) on the subject of tile drainage of artesian areas.

Some of these investigators, van Deemter (9), and Engelund (1), have been primarily concerned with the simultaneous drainage of water seeping down from above supplied by rainfall and/or irrigation and water seeping up from below from artesian pressure. Their treatment of the problem is thus more general.

Kirkham (3), Farr and Gardner (2), and Muskat (7) have considered only seepage from below but for somewhat different boundary conditions than we used. Kirkham (4) has also considered downward seepage.

The problem of dealing with seepage from below is of practical importance in many areas of California, for example, Scott and Luthin (8), and it is for this reason that in our work attention was concentrated on this facet of the more general problem of simultaneous upward and downward flow.

*Numbers in parentheses refer to appended references.

Our results can be compared with those of Muskat and Kirkham. Their investigations indicate that the drain radius has an appreciable effect on the position of the water table. We used an arbitrary drain diameter of 6 in. In all probability a larger drain diameter would more nearly approximate the field situation of a drain surrounded with a gravel envelope or a drain laid in a trench that is backfilled with more pervious material.

In general, our results give less rise of the water table. The water table at the midpoint as computed from analogs is about 1 to 2 ft lower than the equations of Muskat and Kirkham indicate. Their equations are thus more conservative. Field measurements on one system installed under our direction indicate a rough equivalence between our published curves and actual water table heights measured in the field.

There are, of course, many important soil and crop factors which are not included in either the equations developed by others or in our curves. Type of crop and stage of growth can have a marked influence on water tables as demonstrated by Luthin and Bianchi (6) and earlier by White (10).

The major weakness of these as well as other theoretical treatments of the drainage problem is the assumption of homogeneous soil. The occurrence of such soil is the exception rather than the rule and, in fact, it is quite unlikely that such soil will be found. Stratification and/or soil differences resulting from development are the rule and constitute the usual field situation. Kirk-

(Continued on page 767)

. . . Quality Control in Hay Making

(Continued from page 750)

Also, where more than one cutting of hay is made, early cutting with barn drying will result in more pounds of hay, more pounds of TDN and more pounds of digestible protein per acre than can be obtained by cutting later and field curing — from 15 to 40 percent more in feed value, largely due to the extra leaves saved and the higher percent of TDN and protein.

Our 100 million ton hay crop harvested each year would bring farmers an additional billion dollars in feeding value for producing meat and milk if it was harvested at the right stage of maturity and dried under cover with a motor-driven fan or a heated-air crop drier.

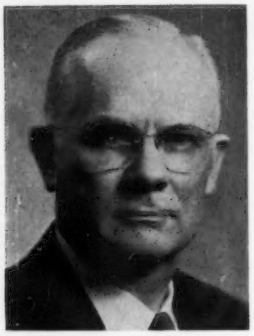
There is no surplus of early-cut quality hay in either farmer or government storage, nor is there any quota or other limitation on the production of this valuable crop. Farmers who plan to stay in business producing milk, beef or sheep need better roughage to reduce production costs or they may not survive in these times with prices dictated by large surpluses.

The hay drier, along with the hay conditioner, opens the way to putting up quality hay every day the sun shines during the haying season. No more waiting for two or three good days in a row to field-cure hay and no need to put it up as grass silage either. Every farmer needs drying equipment NOW to dry hay, corn, small grains, rice, peanuts or beans, etc. It will generally produce a 100 percent return on the investment each year it is used.

The purchase of drying equipment to dry all crops can be one of the most profitable investments a farmer can make and to some it may mean the difference between operating at a profit instead of a loss.

1961 NOMINATIONS ANNOUNCED

Nominee for President-Elect



A. W. FARRALL

Nominations for elective officers of the American Society of Agricultural Engineers for 1961-62 have been reported by the nominating committee: A. C. Dale (chairman); G. M. Eveleth; R. W. Kleis; F. W. Peikert; and J. G. Sutton. Voting will be by letter ballot to be mailed to voting members in February. Closure of voting will be March 31. The 1961 election completes the transition of reorganization of the Council, which began three years ago, to increase the number of Council members from nine to eleven. The new Council will consist of one president-elect, one president, one past-president, three vice-presidents, and one councilor for each of five ASAE divisions. Since the terms of office for councilors will be two years rather than three, three will be elected one year and two on alternate years. The terms of office for vice-president will remain at three years each. The president-elect will serve on the Council for three years — one year before and one year after his term of office as president. Nominees are as follows:

Nominee for President-Elect

Arthur W. Farrall, a native of Nebraska, was born February 23, 1899, in Harvard, and raised on a general-purpose farm. He received his formal education in Nebraska, graduating from Harvard High School in 1917, and attending Nebraska Wesleyan University for two years and the University of Nebraska for two years. He received a B.S. degree in agriculture, with a major in agricultural engineering in 1921 and an M.S. degree in agriculture, with a major in agricultural engineering in 1922 from the University of Nebraska. He took further work in engineering at the University of California in 1925 and 1926. In 1955, the University of Nebraska bestowed upon him the honorary degree of Doctor of Engineering.

From 1922 to 1929, he served on the University of California staff as assistant professor in the agricultural engineering department, teaching and doing research in the field of dairy machinery and equipment and rural electrification. He accepted a position in 1929 as research engineer and director of the Spray Drying Laboratory for Douthitt Engineering Co., where his principal activity was that of developing dairy equipment and spray drying machinery. In 1932, he accepted a position of research engineer with Creamery Package Manufacturing Co., manufacturers of a complete line of refrigeration and dairy processing equipment. He was successively promoted to senior research engineer in 1935 and to director of research in 1942. During these years he was active in the research and design of dairy and food processing machinery, including such items as ice cream freezers, homogenization equipment, pumps, heat exchange equipment, butter manufacturing equipment, vitamin D milk irradiating equipment, and high-speed lightweight ammonia compressors.

From 1945 to date, he has been professor and head of the department of agricultural engineering, Michigan State University. Beginning in 1946, he established and developed a graduate training program at MSU, as well as a special farm equipment service and sales program. Under his leadership, a new agricultural engineering building was built and dedicated in 1948. He has been active in developing industry-education cooperation in the field of agricultural engineering, both through the establishment of special courses and in development of a cooperative research program; and in developing foreign training programs, particularly at the graduate level.

Dr. Farrall has been an ASAE member since 1925 and was elected to the grade of Fellow in 1955. He served as chairman of the Chicago Section in 1945 and chairman of the College Division in 1949. He was instrumental, in cooperation with several ASAE members from Detroit, in establishing the Michigan Section. He also established the first student club in agricultural engineering in 1946 at Michigan State University. He has been a member of the ASAE Forward Planning Committee since 1959, and was co-chairman of the College Section of the Motion Picture Finance Committee in 1958-1959.

At present, he is chairman of the Agricultural Engineering Division of the American Society for Engineering Education, and also a member of the American Association for the Advancement of Science, Institute of Food Technologists, American Dairy Science Association, Gamma Sigma Delta, Sigma Xi, and Tau Beta Pi honorary engineering society. He is a member of the Michigan State University Patent Committee; was general chairman of the Centennial of Farm Mechanization at MSU in 1955, and has been a member of the Research Advisory Committee for the National Restaurant Association Research Laboratory since 1956. He was acting chairman of the Food Technology program at MSU for 1959-60; was a member (engineering representative) of an eleven-man delegation appointed by the U.S. Department of State to represent United States dairy industry at the International Dairy Congress, Stockholm, Sweden, in 1949.

His publications include a textbook, Dairy Engineering. Also he has served as associate editor for Dairy Handbook and Dictionary. As an inventor he has patents on an electronic ice cream freezer control, continuous ice cream freezer, fruit feeder for freezers, continuous butter machine and continuous dry fat producing apparatus.

He is a member of the Congregational Church, in which he has served as chairman of the Board of Trustees, president of men's club and member of the Board of Deacons. He was married in 1923 to E. Luella Buck, and they have two children — a son, Robert, who is photometric engineer for General Electric Co., and a daughter, Margaret.

Nominees for Councilor — *Power and Machinery Division*

C. S. Morrison

C. B. Richey

Nominees for Councilor — *Farm Structures Division*

M. L. Burgener

S. S. DeForest

Nominees for Councilor — *Education and Research Division*

D. T. Kinard

E. T. Swink

Nominees for Vice-President

Howard Matson

R. R. Poynor

Nominees for Vice-President

Howard Matson was born in Thayer County, Nebr., in 1902. He received a B.A. degree from Cotner College in 1924; a B.S. degree in agricultural engineering in 1927 and an M.S. degree in agricultural engineering in 1929, both from the University of Nebraska.

In 1929 he accepted the position of extension architect at Kansas State University. From 1930 to 1933 he was a member of the staff at the University of Kentucky as an instructor and extension specialist for farm buildings and sanitation. During 1933 and 1934 he was in charge of engineering work for seven CCC erosion control camps

(Continued on page 770)

HIS WELL AND POST DRIVER SAVES LABOR

Driving irrigation wells in tough, waxy gumbo soil was quite a problem for Robert Hawthorne (right), manager of the T. E. Pemble plantation, Merigold, Mississippi. So, he rigged up a combination well and fence post driver that not only solved the problem, but was a big labor saver as well. In building it, he utilized parts from a wrecked trailer, an old tractor and lengths of pipe.

While he knows how to do things for himself, Bob Hawthorne also appreciates the help he gets from others—Texaco Distributor C. M. Shaw, Jr., for example. "He's one of the friendliest and most helpful men I ever had dealings with," he says. Bob depends on Advanced Custom-Made Havoline Motor Oil for long engine life, and Fire Chief gasoline for lively fire-power and more draw-bar pull.

Like farmers everywhere, Mr. Hawthorne has found that it pays *to farm with Texaco products.*

Another good "Texaco" farmer W. A. Wedberg (left), who farms 1,000 acres near Valley, Neb., fuels and lubricates his 5 tractors and 2 trucks (also his son's 1½ HP farm-made auto) with Texaco products supplied by Consignee Arthur Stark, of Fremont.

Mr. Wedberg knows that Texaco Marfak lubricant best protects bearings of field machinery against the punishment they take in field work. It forms a tough collar around open bearings, and won't jar off, wash off, melt down, dry out or cake up.

BUY THE BEST...BUY TEXACO

TUNE IN: TEXACO HUNTLEY-BRINKLEY REPORT, MONDAY THROUGH FRIDAY, NBC-TV

Winter Meeting Highlights

THE 1960 Winter Meeting of the American Society of Agricultural Engineers will be held December 4-7 at the Peabody and Chisca Hotels in Memphis, Tenn. Registration will begin at 1:00 p.m., Sunday, December 4. Advance registration cards and hotel reservation forms have been mailed to ASAE members. Non-members interested in attending the meeting should communicate with the central office of the Society at St. Joseph, Mich., for information on accommodations and the program of the meeting sessions. A Cabinet Meeting will be held Sunday, December 4, at 8:00 p.m. in the Georgian Room of the Peabody Hotel.

The technical sessions will open on Monday morning, December 5, with the Power and Machinery Programs "A" on chemical application—session I and Program "B" on tractors—session I; Soil and Water on irrigation; Farm Structures on farm building construction; and Electric Power and Processing on automation in agriculture. The five concurrent sessions scheduled for Monday afternoon will include: Electric Power and Processing on developments in materials handling; Power and Machinery—Program "A" on forage harvesting and Program "B" on cotton processing; Soil and Water on hydrology; and Farm Structures on building design.

The subjects to be presented on the five concurrent sessions set up for Tuesday morning are: Farm Structures, farm housing; Electric Power and Processing, farm wiring developments and needs; Power and Machinery—Program "A", chemical application—session II and Program "B," crop culture; and Soil and Water, soil erosion.

The Wednesday morning concurrent sessions will be six in number and consist of: Soil and Water—Program "A," drainage design and Program "B," drainage research; Farm Structures, environment in livestock buildings and its control; Electric Power and Processing, radiation in agriculture; Power and Machinery—Program "A," testing and analysis and Program "B," general. The five sessions scheduled for Wednesday afternoon will cover: Power and Machinery—Program "A," harvesting and Program "B," tractors—session II; Soil and Water, irrigation; Farm Structures, poultry housing; and joint Farm Structures and Electric Power and Processing, solar energy in agriculture.

General Session

A. B. Kinzel, vice-president of research, Union Carbide Corp., New York, N. Y. and president, Engineers Joint Council, will address the General Session on Tuesday afternoon. His subject will be "EJC and Its Relationship to ASAE." Wheeler McMillen, vice-president, Farm Journal, Inc., Philadelphia, Pa., will also be a featured speaker at this session when he will discuss "Public Relations in Agriculture."

4-H Electric Program

At 4:00 p.m. on Tuesday H. S. Pringle, extension agricultural engineer, Extension Service, USDA, Washington, D. C., and John Hallenberg, assistant manager, Power Use Department, Westinghouse Electric Corp., East Pittsburgh, Pa., will lead a discussion on the 4-H Electric Program.

A. B. Kinzel

Speakers During General Session December 6

Wheeler McMillen

A. B. Kinzel, vice-president of research, Union Carbide Corp., and president of Engineers Joint Council, will address the General Session Tuesday afternoon concerning EJC and its relationship to ASAE, and Wheeler McMillen, vice-president, Farm Journal, Inc. will speak on public relations in agriculture

Research Program

In keeping with its theme "Use of Computers in Research" the Research Program on Monday afternoon will feature presentations by C. E. French, agricultural economics department, Purdue University, on computers for management, and by R. W. DeSio, manager, Midwest Region Applied Science Department, IBM, Chicago, Ill., on problem analysis by computer. Discussions will follow these addresses by H. W. Van Gerpen, project engineer, John Deere Tractor Research and Engineering Center, and D. B. Brooker, associate professor, agricultural engineering department, University of Missouri.

Extension Program

The Extension Program will be in the form of a breakfast session on Monday morning, December 5, and will feature a panel discussion on the question "How does a farmer get better farmstead engineering assistance?" Members of the panel will be Robert Aldrich, Michigan State University (moderator); Lawrence Skromme, New Holland Machine Co.; Robert Gilden, Federal Extension Service; Earl Anderson, Stran-Steel Corp.; Robert Morrow, American Planter Corp.; Willard Cutler, Michigan State University; and Charles Powell, Doane Agricultural Service.

Special Features

At 4:00 p.m. on Tuesday the Farm Structures Division will hold its traditional milker with Jack Timmons, commercial manager, KWKH, Shreveport, La., who will speak on "Agriculture's Weakest Link." At 6:00 p.m. the FEI dinner will be held and at 3:00 p.m. on Monday, a Personnel Service Contact session will be conducted.

BULLETIN

Any individual or committee desiring to submit proposals for consideration by the ASAE Council during the Winter Meeting are asked to submit a one-page explanation of their proposal to the ASAE executive secretary.

Sedimentation Laboratory Open House

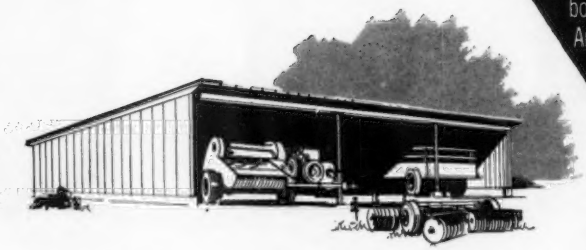
The staff of the Sedimentation Research Laboratory extend a cordial invitation to the members of ASAE, who attend the Winter Meeting at Memphis, to visit its new facilities at Oxford, Miss. Oxford is approximately 80 miles southeast of Memphis and is the home of the University of Mississippi. An open house is planned for December 8, the day after the completion of the ASAE Winter Meeting.

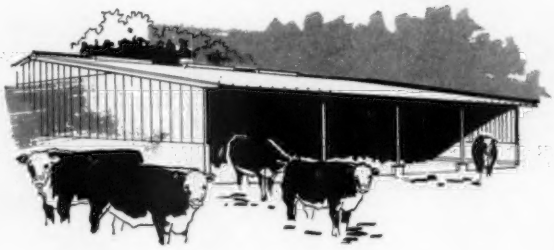
Farm Structures Day

Latest developments in panelized farm buildings and converting old farm buildings to grain storage will highlight the 1960 Farm Structures Day program at the University of Illinois, Urbana, Thursday, November 17. Farm Structures Day is sponsored jointly by the University department of agricultural engineering and the Illinois Retail Lumber and Material Dealers Association.

Other high-interest features on the program include a discussion on new developments in wood trusses, insulation and ventilation of livestock shelters, and tips on prefabrication. Of equal interest will be the discussion of farm grain storage. G. C. Shove of the UI agricultural engineering department will compare the cost and service life relationships betwen rigid frame, tilt-up concrete and other new types of grain storage structures with the more conventional types found on many Illinois farms. He will also have on display a model of the self-supporting portable walls he has developed to adapt old farm buildings to corn and small grain storage.

New steels are born at Armco





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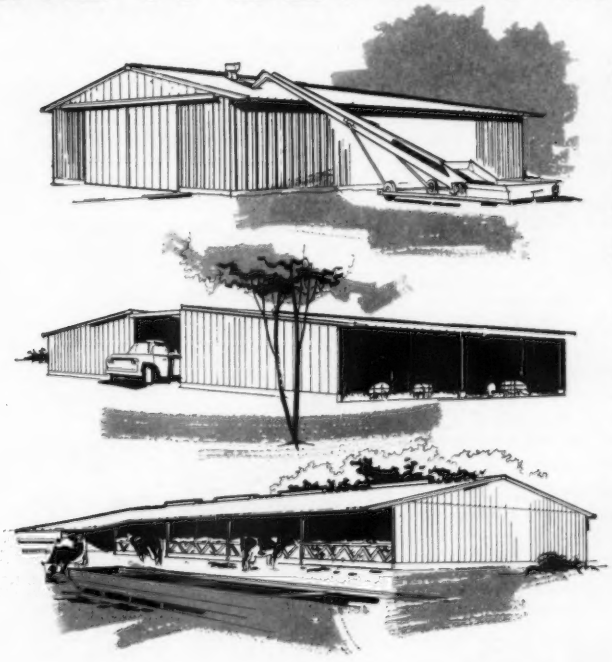

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A. Earl Lee

T. N. Jones

E. D. Wilborn

A. Earl Lee has been appointed vice-president in charge of the newly established marketing division of J. I. Case Co., Racine, Wis. In his new position he assumes responsibility for all sales and merchandising activities, including sales, advertising, parts, service, and related supporting staff functions. He previously was marketing coordinator.

T. N. Jones, agricultural engineer, Mississippi Agricultural Experiment Station, Mississippi State University, State College, Miss., was recently promoted to Brigadier General in the Mississippi National Guard. His retirement in the National Guard also became effective July 1, 1960. He has held a commission for 32 years and served on active duty in the United States Army during World War II and the Korean conflict.

E. D. Wilborn has been named editor of the Mississippi-Arkansas-Louisiana edition of *The Progressive Farmer* magazine. Joining the staff in 1953 at the Dallas, Texas, office, he has been an associate editor until his recent promotion.

Wayne F. Kroutil has recently joined the agricultural engineering department staff at California State Polytechnic College, San Luis Obispo, Calif., as an instructor. He previously took graduate work at the agricultural engineering department, Oklahoma State University, and also has been associated with John Deere Harvester Works and International Harvester Co., East Moline Works, in the design departments.

Wesley L. Harris recently has been appointed assistant professor of agricultural engineering at the University of Maryland, College Park, where he will be engaged in teaching and research. He is at present a graduate assistant at Michigan State University, East Lansing, where he will soon complete requirements for a Ph.D. degree in agricultural engineering. He will then assume his new duties at the University of Maryland.

Juan B. Uy has recently been promoted to the position of director of the Physical Plant at the University of the Philippines, Quezon City.

W. F. Kroutil

W. L. Harris

P. John Zachariah has been appointed director of the Tractor Training and Testing Station, Government of India, Budni (Madhya Pradesh), India. Prior to this appointment, he was connected with the Government of India as deputy director of engineering for soil conservation, under the Ministry of Food and Agriculture in New Delhi. *(Continued on page 768)*

NECROLOGY

Joseph F. Schaffhausen, president of Martin Steel Corp., Mansfield, Ohio, died suddenly on October 7, while attending a business conference in Bridgeport, Conn. He was born August 28, 1906, in Englewood, N. J. He was educated at Rutgers University and the University of New Mexico. His early experience had been with the U. S. Soil Conservation Service, and for many years he was manager of the Farm Market Division of Johns-Manville Corp. He later was president of the Cockschutt Farm Equipment Co., Bellevue, Ohio, and also served as president of the Farmers Financial Agency of New York. He had been publisher of American Coal Journal and at the time of his death was also president of Open Gate Farms, Inc., an experimental farm in Bucks County, Pa. He was founder and president of the Schaffhausen Corp., an industrial management firm of New York and Connecticut. He had been president and chairman of the board of Martin Steel Corp. since 1957.

J. F. Schaffhausen

Mr. Schaffhausen was nationally known for his "Farm Engineer" column which appeared regularly for over 15 years in the *Country Gentleman* magazine and for numerous articles in the *Saturday Evening Post* and other publications. During World War II, he was advisor on farm production problems to the War Production Board and the U. S. Department of Agriculture.

He had been an ASAE member since 1940 and served the Society as chairman of the Farm Structures Division. He was also the Jury chairman for the first MBMA Award. He was one of the founders and a past-president of the Farm Club of New York and held offices with other leading organizations, including American Lumbermen's Association and National Farm Equipment Association. He is survived by his wife, a son, and a daughter.

James E. Lyle, manager of engineering, International Harvester Co. of Mexico S. A. de C. V., Mexico City, died suddenly on September 5. He was born February 26, 1901, in Chattanooga, Tenn., and graduated from Central High School in Chattanooga. His 41-year association with International Harvester Co. began in 1919 when he accepted a position of draftsman in its Chattanooga plant. He successively was chief engineer at the Chattanooga plant; product engineer at the Canton, Ill., plant; product engineer at the Memphis, Tenn., plant, and since 1949 manager of engineering at Mexico City, Mexico.

J. E. Lyle

He had been a member of ASAE since 1958, and also held a membership in the Society of Automotive Engineers. He was a charter member of the Signal Mountain Presbyterian Church, and a member of the Rotary Club. He is survived by his wife, Alice; a daughter, Mrs. Betty Lyle Thode of Austin, Texas; and a son, J. E. Lyle, Jr., of Florence, Ala.

Oliver M. Twist, checker in the engineering department, Caterpillar Tractor Co., Peoria, Ill., was killed in a light plane crash on June 26 near Washington, Ill. He was a native of Illinois, his birthplace being DeWitt, and the date of his birth June 9, 1922. He attended California Institute of Technology, pursuing an aeronautical engineering curriculum. During World War II he was a pilot in the U. S. Naval Reserves. From 1944 to 1949 he operated his grain and livestock farm in DeWitt, Ill. In 1949, he joined Caterpillar Tractor Co. in Peoria, Ill., as a sheet metal trainee, and progressively was detailer and layout man in the agricultural section of the engineering department; special representative, agricultural section, sales development division; and checker, engineering department. He also, at the time of his death, operated a farm near Washington, Ill.

O. M. Twist

He had been an ASAE member since 1953 and was also a member of the Society of Automotive Engineers. He was an active member of the Washington Christian Church, where he was an elder. He is survived by his wife, Violet, and three sons, Matthew, Milo, and Robert.

. . . Readers' Forum

Tile Drain Spacing

(Continued from page 761)

ham (5) discusses some aspects of this problem.

An exact mathematical solution for the problem studied by us can be found using mathematical procedures outlined by Kirkham (5).

The equation for the hydraulic head, ϕ is

$$\phi = q \log [\cosh 2\pi\, y/a - \cos 2\pi\, x/a] / [\cosh 2\pi\, (y+2b)/a - \cos 2\pi\, x/a] + C \quad [1]$$

where $q = -\phi_a / \log [\cosh 2\pi\, r/a - 1] / [\cosh 2\pi\, (r+2b)/a - 1]$

and $C = \phi_a$

ϕ_a = hydraulic head in artesian aquifer

r = radius of tile drain

a = spacing of drains

b = distance from tile line to artesian layer

x, y = horizontal and vertical coordinates measured from the origin which coincides with the top-center of a tile drain

log = natural logarithm

The stream function is given by

$$\psi = 2q \{\tan^{-1} [\tanh \pi\, y/a) (\cot \pi\, x/a] + \tan^{-1} [(\tanh \pi\, (y+2b)/a) (\cot \pi\, x/a)]\} \quad [2]$$

An approximate expression for the water table height at the midpoint can be found by considering the hydraulic head at the midpoint and at the same elevation as the top of the tile.

$$\phi\ (x = S/2,\ y = 0) = -\phi_a \log [2/(\cosh 4\pi\, h/a + 1)] / [\log (\cosh 2\pi\, r/a - 1) / (\cosh 2\pi\, (r+2b)/a - 1)] \quad [3]$$

The water table heights calculated by this expression will be somewhat higher than the actual heights. The difference being greater for smaller distances to the artesian gravel.

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INTERNATIONAL HARVESTER COMPANY PROMOTIONS

H. P. Smith

J. E. Bornzin

R. I. Birkholz

C. V. Everett

Several promotions involving ASAE members have been announced by the Farm Equipment Research and Engineering Center of International Harvester Co., Hinsdale, Ill.

Hiram P. Smith has assumed the duties of divisional staff engineer in which post he will be responsible for special engineering projects. His association with IH began in 1930 at Canton, Ill. He joined the Farm Equipment Research and Engineering Center, where he has been assistant manager of engineering, at the time the farm implement and farm tractor divisions were consolidated.

James E. Bornzin has been appointed assistant manager of engineering, farm equipment division. He has worked in a variety of management positions in engineering operations for the company in Chicago, Ill., Auburn, N. Y., and Memphis, Tenn. Prior to his new appointment, he served as divisional chief engineer, test and development, of the farm equipment division.

Raymond I. Birkholz has been appointed staff assistant of tractor product engineering. He joined the company in 1935 at the Chicago Tractor Works and was subsequently transferred to the industrial power division and then to IH of Great Britain, Ltd. After his return to the United States he assumed the duties of assistant divisional chief engineer of tractor product engineering.

Charles V. Everett has been appointed chief engineer, materials handling machines section, product engineering. He joined the company in 1956 at the McCormick Works in Chicago and was transferred in 1959 to Hinsdale as chief engineer, harvesting machines section, which position he held prior to his new appointment.

Lawrence I. Frisbie has been appointed chief engineer, chassis section, product engineering. He started with the company's test and development department in 1945, was promoted to assistant chief engineer, hydraulic section, and has served in the capacity of assistant chief engineer, chassis section from 1952 until his recent appointment.

Paul R. Sonneman has been appointed to the position of standard parts design engineer. He began with the company at Rock Falls, Ill., in 1929. He later was transferred to the McCormick Works in Chicago, but returned to Rock Falls in 1946 as chief engineer. When the farm tractor and farm implement engineering departments consolidated he was assigned to the position of product engineer at Hinsdale, Ill.

Herbert C. Glesmann has been appointed to the position of product engineer in the industrial tractor section. He started with the company in 1956 in the farm tractor engineering department and progressed through several promotions to become project engineer, which is the position he held prior to his recent promotion.

L. I. Frisbie

P. R. Sonneman

H. C. Glesmann

R. N. Coleman

L. L. Choat

B. T. Gillis

Richard N. Coleman has been appointed to the position of staff assistant, test and development engineering. He started with the company in 1939 as a tester in the gas power engineering department and was promoted to product development engineer in 1946. In 1952, he was advanced to the post of chief product development engineer, field laboratory, where he served until his recent promotion.

Lyle L. Choat has been appointed chief product development engineer, field laboratory. He began his association with Harvester in 1955, as a test engineer in the farm tractor engineering department. After serving in various capacities within the test and development section, he was promoted to product development engineer in 1958, which post he has held until his current promotion.

Benton T. Gillis has been appointed to the post of product development engineer in the south laboratory. He joined the company in 1956 as a member of the farm tractor engineering department. He comes to his present position with a background in the test and development section, having served as both test engineer and project engineer in that area.

. . . ASAE Members in the News

(Continued from page 766)

Lloyd Johnson advises that he is now located in Manila, The Philippines, where he is agricultural engineer with the Rockefeller Foundation to establish facilities for The International Rice Research Institute. He formerly was with United Fruit Co. in Guatamala.

Martin M. Fogel has been appointed to the position of irrigation engineering specialist at the University of Nevada, Reno. Prior to this appointment he was extension irrigation specialist at South Dakota State College, State College Station.

Jeffrey J. Thomas, who has been an engineer in the applied mechanics laboratory of English Electric Co., Ltd., Stafford, England, is now associated with Massey-Ferguson, Coventry, England, as a field test engineer.

Jack C. Williams recently has been transferred from the Chicago, Ill., office to the Palo Alto, Calif., office of American Concrete Pipe Association. In his new location, he is the association's western region representative.

EVENTS CALENDAR

November 14-18—*National Electrical Manufacturers Assn.* Annual Meeting, Traymore Hotel, Atlantic City, N. J.

November 15-17—*Building Research Institute Fall Conferences,* Shoreham Hotel, Washington, D. C. Further details may be obtained from BRI, 2101 Constitution Ave., Washington 25, D. C.

November 17 — *Farm Structures Day,* University of Illinois, Urbana, Ill.

November 18-24 — *Farm-City Week.*

December 5-8—*1960 Meeting of the American Society of Agronomy,* Morrison Hotel, Chicago, Ill. For further details contact ASA headquarters at 2702 Monroe St., Madison 5, Wis.

December 7-8 — *Seminar on Metal Cutting,* Dinkler Plaza Hotel, Atlanta, Ga. Sponsored by the American Society of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.

December 12-15 — First *Industrial Building Exposition and Congress,* New York Coliseum. Information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

January 9-13 — *International Congress and Exposition* of the *Society of Automotive Engineers,* Cobo Hall, Detroit, Mich. Contact SAE, 485 Lexington Ave., New York 17, N. Y., for additional information.

February 5-11 — *National Electrical Week.*

February 12-16 — *National Rural Electric Cooperative Assn. Annual Meeting,* Dallas, Texas.

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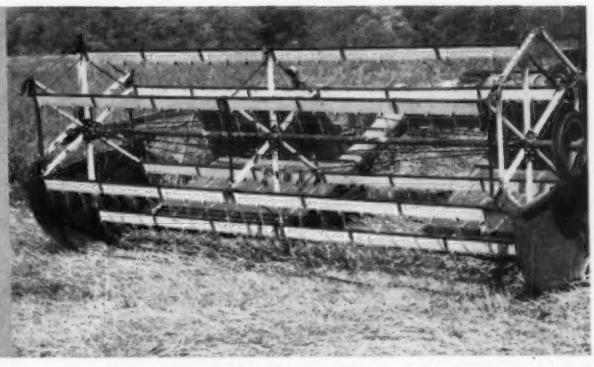

. . . Nominations

(Continued from page 762)

in western Kentucky. From 1934 to 1936, he was with the U.S. Department of Interior as a project engineer in the Soil Erosion Service in Lindale, Texas. He accepted the position of chief, engineering division, USDA Soil Conservation Service Regional Office in Fort Worth, Texas, in 1936, where he was successively appointed chief, water conservation division (1944-1953), and head, engineering and watershed planning unit, which he holds at the present time.

Mr. Matson has been an ASAE member since 1930 and has served the Society as: Councilor; chairman of the Soil and Water Division; and chairman, Hydrology Group, Soil and Water Division. He also has served as a member of the following: Meetings Committee; Committee on Soil and Water Subject Matter Classification; Subcommittee on Drainage Laws; ECPD Inspection Committee; Soil and Water Division Steering Committee; and Committee on Journal Paper Awards. He has also served as chairman of the Southwest Section and has been a member of its Program Committee and Committee on Student Paper Awards.

He is a charter member of the Soil Conservation Society of America, and also is a member of the National Society of Professional Engineers, Sigma Tau, Phi Mu Alpha, and is a registered professional engineer in the state of Texas. He is listed in "American Men of Science" and "Who's Who in the South and Southwest."

Russell R. Poynor was born on September 13, 1913, in Waunakee, Wis., and was raised on a livestock farm in southern Wisconsin. He received a B.S. degree in agriculture in 1935 from the University of Wisconsin, a B.S. degree in civil engineering in 1937, also from the University of Wisconsin, and an M.S. degree in civil engineering from Purdue University in 1943. He was affiliated with the Soil Conservation Service in Wisconsin for one year; was a member of the engineering staff at Utah State University for three years; and was a member of the agricultural engineering department staff at Purdue University, where he did teaching and research, for five years. In 1945, he joined International Harvester Co. at its Canton Works engineering department. He was transferred to the company's general office in Chicago in 1947, as agricultural engineer in the Farm Implement Division. In 1953, he was appointed general supervisor of the farm practice research group, which became a part of the company's farm equipment product planning department in 1957. He is now general supervisor of farm equipment product planning research, which includes following and analvzing changing farm practices and development as they relate to machinery requirements.

He has been an ASAE member since 1937, and has served as chairman of the Soil and Water Division, as well as on the following committees: Soil and Water Division Steering; ECPD Inspection; and Mulch Tillage and Soil Compaction. He is at present serving on the Committee on Research and the Committee on Graduate Instruction. He is also International Harvester's representative on the Agricultural Research Committee of the Farm Equipment Institute and is a member of the USDA Research Advisory Committee on farm equipment structures.

Nominees for Councilor —
Education and Research Division

Drayton T. Kinard was born February 11, 1912, in Dillon, S. C. He received a B.S. degree in agricultural engineering from Clemson College in 1933 and an M.S. degree in agricultural engineering from Virginia Polytechnic Institute in 1941. He later earned a Ph.D. degree from Michigan State University.

After his graduation from Clemson College, he joined the Soil Conservation Service in Spartanburg, S. C., as an engineering aid. In 1936, he moved to Montgomery, Ala., to work with the Farm Security Administration, and in 1937 he became associated with the Daniel T. Duncan civil engineering firm in Columbia, S. C., as a laboratory engineer. He was an engineer for R. H. Bouligny, Inc. until 1940 when he became a graduate research assistant at Virginia Polytechnic Institute. In 1941, he joined the University of Georgia staff as a research associate and was promoted to professor of agricultural engineering in 1955. In 1956, he was named head of the newly formed agricultural engineering department at the University of Kentucky. He accepted his present position as head of the agricultural engineering department at the University of Florida in 1958.

He has been an ASAE member since 1937.

E. T. Swink was born September 7, 1907, on a farm in Augusta Co., Va., where he was also raised. His formal education was received in Virginia also, as he graduated from the Churchville High School and received a B.S. degree and an M.S. degree in agricultural engineering from Virginia Polytechnic Institute. In 1930 and 1931, he was associated with Westinghouse Electric Corp. under its graduate training program. He was district agricultural engineer for the Virginia Electric and Power Co. at Suffolk, Va., from 1932 to 1935. In 1935, he joined the VPI staff as an assistant professor and assistant extension agricultural engineer, doing teaching, extension, and research work in rural electrification. In 1945, he was made associate professor and associate extension agricultural engineer. Since 1954 he has been professor and head of the agricultural engineering department at VPI.

Mr. Swink has authored many technical papers and articles, including one for the *Encyclopedia Britannica* entitled "Electric Power in Agriculture." He also was listed in the 1959 edition of "Who's Who in Engineering."

Since becoming a member of ASAE in 1930 he has been active as chairman of the Electric Power and Processing Division (1953-54) and of the Education and Research Division (1959-60). He has also served on several Society committees including: The Movie Production Committee; and the 1956 National Meeting Committee, of which he was chairman. In 1959, he was elected to the grade of Fellow in the Society.

His professional affiliations also include memberships in the American Society for Engineering Education, and the National and Virginia Societies of Professional Engineers. He is also a member of the board of directors, Blacksburg Chapter, Virginia Society of Professional Engineers, the Presbyterian Church, Christiansburg-Blacksburg Rotary Club, and the Virginia State Grange. He is also a registered professional agricultural engineer in the state of Virginia.

Nominees for Councilor —
Farm Structures Division

Maurice L. Burgener was born January 2, 1924, and raised, on a farm near Olney, Ill. He received a B.S. degree, in 1948, and an M.S. degree, in 1949, in agricultural engineering from the University of Illinois. He joined the Portland Cement Association staff in Chicago, Ill., as an agricultural engineer, in 1949. In 1953 he was promoted to the position of structural engineer for the PCA Farm Bureau. He was again promoted in 1957—this time to manager of the PCA Farm Bureau. In this capacity he supervises the national promotion and educational activities of the association in the farm field.

Since becoming an ASAE member in 1948, he has been secretary of the Chicago Section and received the ASAE Paper Award in the graduate division in 1949. He is presently vice-chairman of the Farm Structures Division Steering Committee, and a member of the Standards Committee, Joint Committee on Animal Shelter Ventilation, Committee on Specifications for Installation of Concrete Irrigation Pipe, and Farm Construction Standards Committee.

He is also a member of the National Association of TV and Radio Farm Directors, American Agricultural Editors Association, American Association of Agricultural College Editors, Tau Beta Pi, Phi Kappa Phi, Sigma Xi, and Alpha Zeta.

Sherwood S. DeForest, a native of Iowa, was born on September 20, 1921, in Ames. He received a B.S. degree in agricultural engineering in 1943 and an M.S. degree in agricultural engineering in 1947 from Iowa State University. From 1947 to 1950, he did extension work in rural electrification at Iowa State University as extension agricultural engineer. From 1950 to 1952, he did extension work in farm structures at ISU. In 1952, he joined *Successful Farming* magazine as engineering editor. In 1959, he accepted the position of development representative, with the development division of U.S. Steel Corp.

He became an ASAE member in 1944 and has been active in the Society as chairman of the Farm Structures Division, Materials Handling Conference Committee, Nominating Committee, and Iowa Section Nominating Committee. He also has served on the following committees: Farm Structures Steering; Farmstead Engineering Conference; Advertising; and Forward Planning.

He is also a member of Sigma Delta Chi, and a registered professional engineer. He co-authored a chapter in the 1960 USDA Yearbook, "Power to Produce." As engineering editor of *Successful Farming* magazine, he initiated and was responsible for two series of articles introducing and applying the concept of materials handling to agricultural production. He also was responsible for the development of the first mechanical fence erection machine for building fence in a one-pass operation.

Nominees for Councilor —
Power and Machinery Division

Charles S. Morrison was born September 10, 1919, on a farm near Black Lick, Ohio. He received a B.S. degree in agriculture, in 1941, and a BAE degree in 1942, from Ohio State University. In 1946, he received an M.S. degree in agricultural engineering from Iowa State University. He has been employed in the product planning division of Deere & Company since 1946 and is now manager of product research and development departments. In this capacity he is responsible for supervising research and product planning activities on a wide variety of farm equipment problems. During World War II, he served as an electronics specialist in the U. S. Naval Reserves.

He has been an ASAE member since 1944, and has been active as chairman of the Power and Machinery Division, as well as chairman of the Quad City Section. He has served also as a member of the Committee on Research and ECPD Inspection. He is currently a member of the Committee

(Continued on page 772)

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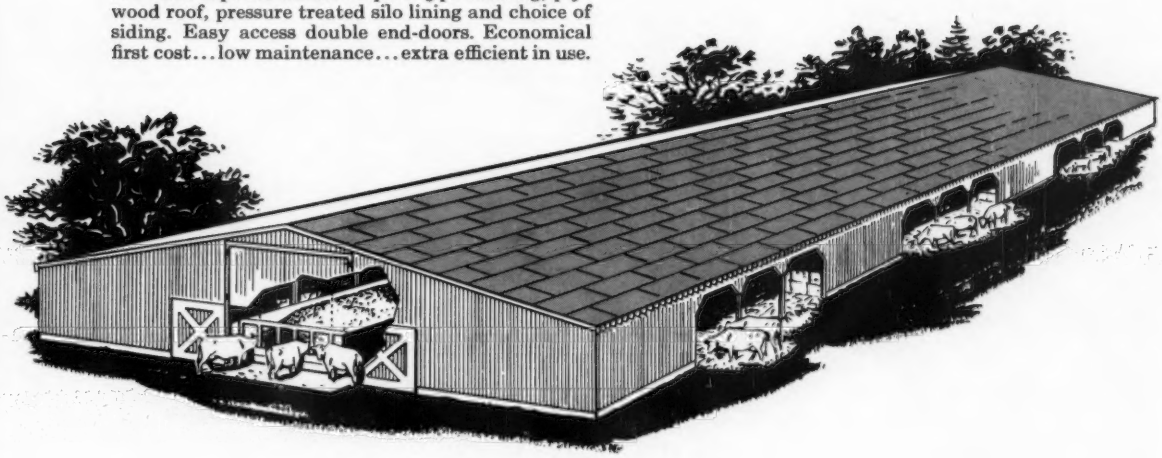

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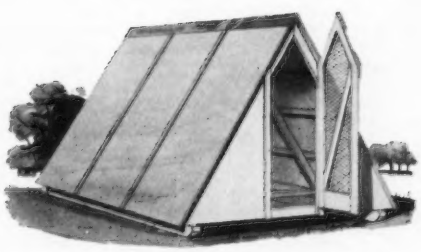

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Minnesota Section

The Minnesota Section held a meeting on September 29 in the ballroom of the new Student Center on the St. Paul campus of the University of Minnesota. It was designated "Ladies Night," and with the ladies present the attendance was 70. National ASAE President L. W. Hurlbut addressed the group, extending the challenge of agricultural engineering and using many fine examples to illustrate his points. The new ASAE motion picture "Agricultural Engineering — The Profession With a Future" was also shown.

Rocky Mountain Section

The Rocky Mountain Section will hold a meeting on April 14 and 15 at the University of Wyoming, Laramie.

Quad City Section

A 6:30 p.m. dinner meeting is scheduled for the Quad City Section on Friday, November 18, at the American Legion Hall, Moline, Ill. L. W. Hurlbut, ASAE president, will speak on a "Decade of Progress." Prior to President Hurlbut's address, past-chairmen of the Quad City Section will be introduced to honor them for their part in the progress of the section. To complete the program, the new ASAE motion picture "Agricultural Engineering — The Profession With a Future" will be presented.

Central Illinois Section

The Central Illinois Section will hold a 6:45 p.m. dinner meeting on Monday, November 28, at the Hotel Lincoln Cafeteria, Lincoln, Ill. The featured speaker will be Melvin Gehlbach, fieldman for Illinois Farm Bureau Farm Management Service. His topic will be "What is the real agricultural problem today? Is there a solution?" The program will also include the showing of the new ASAE motion picture "Agricultural Engineering — The Profession With a Future."

ASAE MEETINGS CALENDAR

November 18—QUAD CITY SECTION, American Legion Hall, Moline, Ill.
November 28—CENTRAL ILLINOIS SECTION, Hotel Lincoln Cafeteria, Lincoln, Ill.
December 5-7—WINTER MEETING, Peabody Hotel, Memphis, Tenn.
December 20 — MISSISSIPPI SECTION, Sedimentation Laboratory, Oxford, Miss.
February 6-8 — SOUTHEAST SECTION, Robert E. Lee Hotel, Jackson, Miss.
March 30-31 — PACIFIC COAST SECTION, Davis, Calif., area.
April 7-8 — MID-CENTRAL SECTION, St. Joseph, Mo.
April 14-15 — ROCKY MOUNTAIN SECTION, University of Wyoming, Laramie.
April 14-15 — SOUTHWEST SECTION, Grim Hotel, Texarkana, Texas.
June 25-28—ANNUAL MEETING, Iowa State University, Ames, Ia.
August 20-23—NORTH ATLANTIC SECTION, University of New Brunswick, Fredericton, N. B., Canada.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

. . . Nominations

(Continued from page 770)

on Research, Committee on Standards, and Forward Planning Committee.

He also is a member of the American Society of Metals and Society of Automotive Engineers.

C. B. Richey was born December 28, 1910, in Winnipeg, Manitoba, Canada. He received a B.S. degree in agricultural engineering from Iowa State University in 1933 and spent the next three years with Sears, Roebuck and Company's Bradley Works, primarily as a time study engineer. From 1936 to 1941, he was an instructor in farm power and machinery at Purdue University, and assistant professor in the agricultural engineering department of Ohio State University from 1941 to 1943. In 1943, he accepted a position with Electric Wheel Co. at Quincy, Ill., where he led a small department in developing new products. He went to Detroit, in 1946, with Harry Ferguson, Inc., as project engineer on hay machinery. He became associated with Dearborn Motors Corp., in 1947, as a project engineer in the research engineering department, and continued with Ford Motor Co. after their purchase of Dearborn Motors Corp. in 1953. Since 1957 he has been the company's chief research engineer in charge of the research engineering department of the Tractor and Implement Division.

Mr. Richey has been an ASAE member since 1934, and his Society activities have included the following chairmanships: Power and Machinery Division; Michigan Section; Power and Machinery Steering Committee; Hay Harvesting Committee; Technical Data Committee; FEI Trophies Committee; and Tractive and Transport Efficiency Committee.

As a spare-time project he is editor-in-chief of the "Agricultural Engineers Handbook," which will be released soon by McGraw-Hill Book Co.

Nominees for Nominating Committee:

Education and Research Division

W. M. Carleton, assistant director, Agricultural Engineering Research Division, USDA, Beltsville, Md. He has been an ASAE member since 1939 and has served as its representative to the Engineering Manpower Commission and the Agricultural Research Institute. He is presently a member of the Committee on Engineers' Classification in Civilian and Military Service, and the Research Committee.

Price Hobgood, head, agricultural engineering department, A. and M. College of Texas, College Station. Since becoming an ASAE member in 1938, he has served the Society in its Southwest Section as secretary-treasurer, vice-chairman and chairman. At the present time he is a member of: The Curriculum and Course Content Committee of the Education and Research Division; the Electric Power and Processing Division Steering Committee; and the Electric Utilization Research Conference Committee.

Electric Power and Processing Division

C. W. Hall, professor of agricultural engineering, Michigan State University, East Lansing. He became an ASAE member in 1948 and has served as chairman of the Electric Power and Processing Division, and chairman of the EPP Division Steering Committee. He also has been chairman of the Committee on Agricultural Processing, a member of the Committee on Bulk Milk Handling, and vice-chairman of the Michigan Section. He is at present vice-chairman of the Research Committee.

H. J. Hansen, editor, Electricity-on-the-Farm Magazine, New York, N. Y. He has been an ASAE member since 1952, and is currently chairman of the Electric Power and Processing Division and also of its Steering Committee. He also is chairman of the Joint Committee on Animal Shelter Ventilation.

Farm Structures Division

H. T. Barr, head, agricultural engineering department, Louisiana State University, Baton Rouge. His ASAE membership dates back to 1924, and he has served the Southwest Section as program chairman, secretary-treasurer, vice-chairman, and chairman. He also has served on the National Nominating Committee and on numerous Power and Machinery Division committees.

B. F. Parker, head, agricultural engineering department, University of Kentucky, Lexington. He has been an ASAE member since 1950 and has served on the Public Relations and Farm Structures Steering Committees. He has also been active in several sections as secretary-treasurer of the North Carolina Section; public relations vice-chairman of the Kentucky Section; and in the Southeast Section has been secretary-treasurer, second vice-chairman, and chairman of a special committee to study activities in farm structures.

Power and Machinery Division

A. M. Best, research and development manager, New Holland Machine Co., New Holland, Pa. He has been an ASAE member since 1942 and has served the Society as chairman of the Pennsylvania Section, and vice-chairman of the North Atlantic Section, as well as chairman of the National Student Branch Committee. He is, at the present time, a member of the Hay Pelleting Committee.

J. B. Liljedahl, professor of agricultural engineering, Purdue University, Lafayette, Ind. He became an ASAE member in 1946 and has been a member of the Curriculum and Course Content Committee for four years, two of which he was chairman. He is presently a member of the Cultural Practice Committee.

Soil and Water Division

J. R. Davis, lecturer and associate specialist and graduate adviser, irrigation department, University of California, Davis. He has been an ASAE member since 1950, and has served as a member of the Soil and Water Division Steering Committee and as chairman of the Soil and Water Drainage Group, Nomenclature Committee and Evapotranspiration Committee. He also has served as collaborator and consultant with the Agricultural Research Service.

L. R. Swarner, chief, Land Resources and Development Branch, Irrigation Division, Region I, Bureau of Reclamation, Department of Interior, Boise, Idaho. Since becoming an ASAE member in 1941, he has served the Society as chairman of the Soil and Water Division Irrigation Group. He is, at the present time, vice-chairman of the Soil and Water Division and a member of its Executive Committee. He also is serving currently on the Nomenclature Committee.

PERSONNEL SERVICE BULLETIN

Note: In this bulletin the following listings current and previously reported are not repeated in detail. For further information, see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this bulletin, request form for Personnel Service listing.

Positions Open—April—O-126-617. **May**—O-171-619, 187-620. **July**—O-237-622, 245-623, 256-624. **August**—O-270-265. **September**—O-271-626, 303-627, 303-628, 303-629, 303-630, 273-631, 284-632, 306-633, 309-634. **October**—O-318-636, 320-637, 322-638, 322-639, 322-640, 324-641, 325-642, 326-643, 341-644, 347-645.

Positions Wanted — April — W-96-26, 110-27, 127-28, 12-29, 117-31, 120-32, 121-33. **May**—W-101-34, 129-36, 156-38, 175-39, 119-40, 158-41, 103-44. **June**—W-207-47, 208-48, 199-49, 193-50. **July**—W-221-53, 238-54, 247-55, 252-57, 253-58, 254-59, 257-60. **August**—W-263-61, 264-62. **September**—W-274-65, 281-66, 282-67, 283-68, 294-70, 287-73, 297-74, 300-75. **October**—W-305-76, 314-77, 323-78, 328-79.

NEW POSITIONS OPEN

Product Design Engineer with experience and ability in production and manufacturing, to lead in designing equipment, supervise small force of engineers, and have active part in overall management. With growing small power equipment division of large manufacturer. Eastern location. Age 35-55. Conservative. Opportunity to grow with business, according to ability. Salary open, under $20,000. O-372-646

Commercial Feed Lot Manager, to advise farmers on proper setup and use of feed lots, for large corporation. Location, Illinois. BSAE, with training in animal husbandry and nutrition. At least 5 years experience in commercial feed lot management. Corporate client will pay all interview expenses, relocation costs, and agency fees. Salary $8,400 minimum, or more depending on experience. Excellent fringe benefits. O-392-647

Director of Engineering to head engineering design, construction and improvement of numerous large bulk storage and handling facilities throughout the United States. Location, New York. Age 40-50. BS degree, preferably in Civil Engineering. MS degree desirable. Some knowledge of electrical engineering helpful. Must have served successfully as an engineering executive in charge of the design and construction of large civil engineering projects, preferably including facilities for handling granular bulk material. Should be skilled in negotiating with and directing work of engineering consultants and construction firms. Opportunity for advancement to Vice-President for engineering. Salary open, attractive for right man. O-393-648

NEW POSITIONS WANTED

Agricultural Engineer for design, development, research, sales, or service, in soil and water field with manufacturer. Any location. Willing to travel. Single. Age 26. No disability. BSAE, 1955, Texas A & M Colle e. Experience with SCS in irrigation, 22 months, GS-7 rating. Commissioned service US Marine Corps 3½ yr. as jet pilot. Additional special training in legal field. Commercial pilot rating. Available January 1961. Salary $7,500. W-338-80

Agricultural Engineer for extension, research, service or writing in soil and water field, with manufacturer, consultant, or public service agency, preferably in north central location. Married. Age 28. No disability. BSAE, 1955, North Dakota Agricultural College. Graduate study at Colorado State University. Farm background. Student trainee with Bureau of Land Management. Agricultural engineer with SCS 5 years, on technical service to irrigated farms. Available January 1961. Salary open. W-377-81

Agricultural Engineer for design, development, or research in soil and water field, with manufacturer, college or experiment station, in Canada, or on temporary basis in United States. Single. Age 22. No disability. BS in agriculture, with specialized training in agricultural engineering at State College of Tropical Agriculture, also at Macdonald College. Summer work experience at reforestation research station and in conservation field. Currently in general soil and water conservation work, including flood control. Available January 1961. Salary $4,000-5,000. W-367-82

Agricultural Engineer for extension, teaching, or research on graduate assistantship. Power and machinery or soil and water. Any location in USA, or India. Married. Age 27. No dis-

(Continued on page 778)

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Chemical and Natural Control of Pests, by E. R. deOng. 240 pages. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $7.50.

This book has been specifically designed to shed new light on the controversial problems of pest control, which centers around the question of the degree to which man can depend on nature for protection against dangerous insects and plant diseases. The author, while emphasizing the importance of control by natural forces shows that nature unaided by chemistry cannot provide the required degree of extermination. The book also gives an accurate picture of the potentialities and limitations of pesticides. It should be of help to the manufacturer, research worker, instructor, and farmer in making an intelligent evaluation of the methods of pest control best suited for his particular purpose.

Proceedings of the First Asian Regional Conference of the International Society of Soil Mechanics and Foundation Engineering. Indian National Society of Soil Mechanics and Foundation Engineering, c/o Central Board of Irrigation and Power, Curzon Road, New Delhi 1, India.

These Proceedings contain papers, discussions, and communications from the Conference held February 4-7, 1960, at New Delhi, India.

Dimension Identification Code for Fluid Power Cylinders. 32 pages. National Fluid Power Association, 5595 N. Hollywood Ave., Milwaukee 17, Wis. $1.00. Quantity discounts quoted upon request.

This book was prepared under the direction of the Cylinder Section of NFPA's Technical Board, extending over 7 years of study. This publication comprises recommended standards for the location of base points and dimensions of fluid power cylinder diagrams, and a code of letters for designating the dimensions. The recommendations cover the various types of mountings, and can be applied to all cylinders regardless of type of construction.

Engineering Applications in Agriculture, by Wendell Bowers and Ben A. Jones. Paper. 8½ x 11 in. 145 pages. Illustrated. Stipes Publishing Co., 10-12 Chester St., Champaign, Ill. $3.75.

This book is designed primarily to stimulate the problem solving ability of non-engineering students and is useful in teaching service courses. Emphasis is placed on use of fundamentals in solving typical problems by application of known principles rather than relying on memory details. The book can be used either for a terminal course in agricultural engineering or a basic course leading to proficiency in one or more of the major areas of agricultural engineering. It is divided into four sections including: Farm electrification; farm surveying; farm structures; and farm power and machinery.

Agricultural Engineering for Extension Workers, by D. N. Kherdekar. Cloth. 6 x 9½ in. 110 pages. Illustrated. Directorate of Extension, Ministry of Food and Agriculture, Government of India, New Delhi, India. Price, 5.50 nP.

This book is one of a series of text books planned by the government of India, primarily for the use of instructors and Gram Sevak trainees in the extension training institution working under the guidance of the directorate. The information contained in the book is based on scientific research and practical experience and should be of use to the general farm reader, as well. Under the extension program an effort is being made to modernize Indian agriculture, and this book provides a good deal of information on agricultural requirements of the small farmers as well as of the larger holders in the different agro-climatic regions of the country. Its range is wide, covering the implements of tillage, irrigation, harvesting and processing, plant protection, subsidiary farm industries, etc.

The book, as a tool of the extension worker, offers great assistance in his attempt to gain general acceptance of the transition from simple and primitive machines to large mechanical equipment.

Nutritional Evaluation of Food Processing, edited by Robert S. Harris and Harry von Loesecke. Cloth. 6 x 9½ in. xviii + 612 pages. Illustrated and indexed. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $12.00.

In this book, the known effects of processing upon the nutrient content and nutritional value of foods are evaluated. Wherever possible suggestions are made regarding changes in processing procedures which would minimize losses in nutritional value. Thirty-three authors contributed to this volume in which the effects of the fol-

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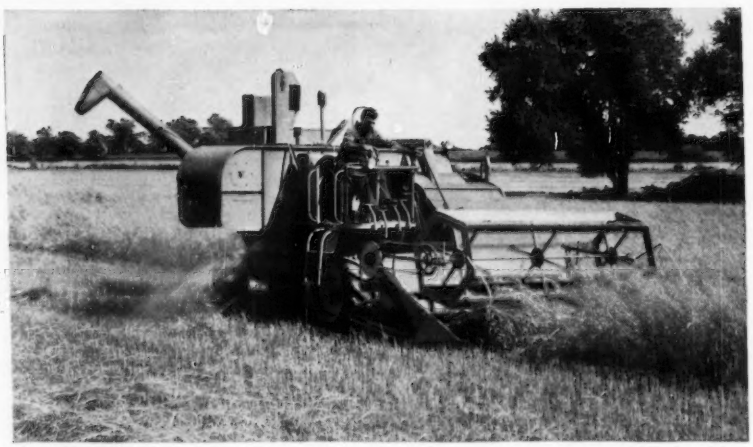

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lowing are discussed: Agricultural practices on the composition of foods; harvesting and handling practices on composition of unprocessed foods; commercial processing on the composition of fruits and vegetables; commercial processing of milk and milk products on nutrient content; commercial processing of cereals on nutrient content; commercial processing of oilseeds and oils on their composition; commercial processing on the nutrient composition of meat, poultry, and fish products; packaging on maintenance of nutrients in food products; commercial storage on the nutrient content of processed foods. Loss in nutrients during large-scale preparation for direct feeding, losses in nutrients during home preparation of foods, methods for increasing the nutritive value of foods, and factors affecting utilization of food nutrients by the normal organism are also covered in the book.

Directory of University Research Bureaus and Institutes, First Edition. Cloth. 8½ x 11 in. 200 pages. Published by Gale Research Co., 34th Floor, Book Tower, Detroit 26, Mich. $20.00.

This book is a reference guide to university research bureaus, institutes, centers, experiment stations, laboratories, etc. set up on a permanent basis and carrying on a continuing program of research in specialized fields. It contains 1500 listings in 250 fields, including: Business, population, education, engineering, public administration, electronics, Slavic studies, tropical meteorology, cosmic rays, personality assessment, insect pathology, folklore, Russian studies, explosives, labor relations, community planning, aeromedical and physical environment, judicial administration, etc. Each listing includes the following data: Official name of bureau or institute; address; name of sponsoring college or university; name and title of director; year founded; size of professional staff and non-professional staff; title and frequency of issue of serial publications; description of research program and activities; and list of professional meetings, special programs and seminars.

NEW FILM RELEASES

The Earth is the Lord's. 13½ min. Color and sound. For information, write to: Farm Equipment Institute, 608 S. Dearborn St., Chicago, Ill.

The REA Story. 16mm. 27½ min. Color and sound. This film reviews the 25-year history of the Rural Electrification Administration, stressing the importance of electric power to farms and ranches in remote areas. Highlights are scenes showing farm life before and after electricity, especially its benefits to women and young people. Includes a modern, electric-powered poultry farm; modern dairy farming operations; and an airplane tour with a flying manager of a Montana electrical cooperative. Write to Motion Picture Service, U.S. Department of Agriculture, Washington 25, D. C. for information.

The Mechanization of Feeding Dairy Cows in Stanchions. 16mm. Color and sound. Part I—13 min. and Part II—6 min., 10 sec. This film shows the results of research on a semi-automatic feeding system for dairy cows in stanchions. It is in two parts—the first part covers the entire system, while the second part shows the details of the silage metering device. The film should be of general interest to students, university staff, equipment manufacturers, county agents, vocational agricultural groups and farm groups. Available at The Vermont Film Library, University of Vermont, Burlington, Vt.

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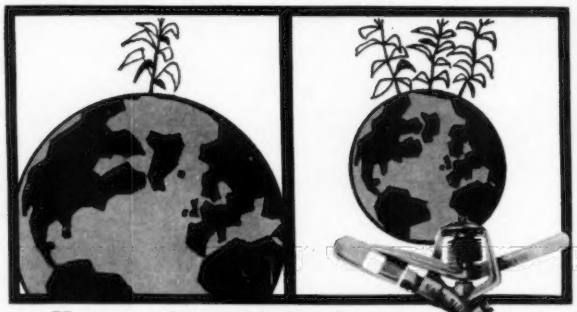

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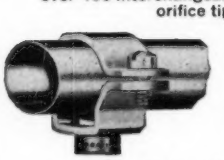

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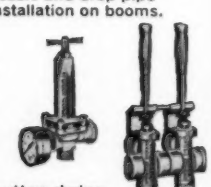

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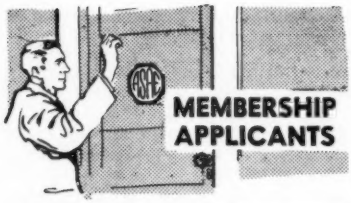

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Banerjee, Asim K. — Asst. res. officer, National Dairy Res. Inst., India. (Mail) 126 Chittenden Ave., Columbus, Ohio

Barlitt, Harl R., Jr. — Zone mgr., farm equip. sales, International Harvester Co. (Mail) R.R. 1, Box A-84, Summerfield, Fla.

Barnes, R. C., Jr. — Agr. engr., (SCS) USDA. (Mail) 5404 Wonder Dr., Fort Worth, Texas

Bates, Eric S. — Market services rep., British Petroleum (North America) Ltd., 620 Fifth Ave., New York 20, New York

Ersayan, Altan — Asst. in agr. eng., Ataturk University. (Mail) 207 Agr. Hall, University of Nebraska, Lincoln 3, Nebr.

Furr, Jones B. — Asst. state conserv. engr., (SCS) USDA, P.O. Box 610, Jackson 5, Miss.

Goehlich, Horst F. B.—Engr., Landmaschinen-Institut der Universitat Gottingen. (Mail) agr. eng. dept., Pennsylvania State University, University Park, Pa.

Gumucio, P. Roger — Vice-pres. and eng. mgr., Miller Mfg. Co., and gen. mgr., Miller International Co. (Mail) 1304 Payne Ave., Modesto, Calif.

Harrison, Maurice B. — Agr. officer, Ministry of Agr. and Lands, Kingston 6, Jamaica, W. I.

Hill, George O. — Asst. prof., farm machinery sales and services, Agr. and Tech. Institute, State University of N. Y., Canton, N. Y.

Hofmann, Erwin H. — Agr. engr., (SCS) USDA. (Mail) 27 Spanish Ravine, Apt. C, Placerville, Calif.

Ibanez C., Mario — Farm machinery teacher and head of farm machinery res. program, agr. eng. dept., University of Concepcion, Chillan, Chile, S. A.

Klima, Karel — Res. engr.,-metallurgist, mfg. res. dept., International Harvester Co. (Mail) 3620 W. 27th St., Chicago 23, Ill.

Lechtenberg, Mark W. — Sr. tool engr., Electric Wheel Co., Div. of Firestone Tire and Rubber Co., 1120 N. 28th St., Quincy, Ill.

Lund, Walter G. — Construction supt., Pelco Structures Inc. (Mail) 1115 N. Ellis, Peoria, Ill.

Payne, Horace W. — Soil physicist, Ministry of Agr. and Lands, Kingston 6, Jamaica, W. I.

Reger, James S. — Drainage eng. advisor, ICA. (Mail) USOM, American Embassy, Santiago, Chile, S. A.

Shumaker, Robert F. — Production engr., Eversman Mfg. Co., Curtis and Fifth Sts., Denver 4, Colo.

Taylor, Lewis C. — Instr., agr. eng. dept., University of Minnesota, St. Paul, Minn.

Uyechi, T. Robert — Asst. des. engr., Exp. Sta., Hawaiian Sugar Planters Assn., 1527 Keeaumoku St., Honolulu, Hawaii

Weston, Curtis R. — Asst. prof., agr. eng. and educ., University of Missouri, 103 Agr. Eng. Bldg., Columbia, Mo.

Willms, Emil F. — Agr. engr., (AMS) USDA, Room 303, Agr. Eng. Bldg., College Station, Texas

Young, Robert A. — Agr. engr. (SWCRD) (ARS) USDA, Morris, Minn.

TRANSFER OF MEMBERSHIP

Kroutil, Wayne F. — Asst. prof., agr. eng. dept., California State Polytechnic College, San Luis Obispo, Calif. (Associate Member to Member)

Mills, Kermit C. — Ext. agr. engr., ext. service, agr. eng. dept., University of Kentucky, Lexington, Ky. (Associate Member to Member)

Prince, Ralph P. — Asst. prof., agr. eng. dept., University of Connecticut, Storrs, Conn. (Associate Member to Member)

Walker, John N. — Asst. prof., agr. eng. dept., University of Kentucky, Lexington, Ky. (Associate Member to Member)

STUDENT MEMBER TRANSFERS

Bishard, Arnold C. — (Colorado State University) 1050 Littleton Blvd., Littleton, Colo.

Campbell, Keith A. — (University of Maine) East Corinth, Me.

Clayton, Joe E. — (Clemson College) Agr. engr., (ARS, AERD), USDA, Delta Branch Exp. Sta., Stoneville, Miss.

Clegg, Joseph J. — (University of Illinois) R.R. 4, Jacksonville, Ill.

Cooper, Harry E. — Agr. eng. dept., Pennsylvania State University, University Park, Pennsylvania

Cowart, David G. — Agr. eng. dept., University of Arkansas, Fayetteville, Ark.

Diener, Robert C. — (Pennsylvania State University) R.R. 4, Brookville, Pa.

(Continued on page 778)

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. . . Personnel Service

(Continued from page 773)

ability. Bachelor of technology in agricultural engineering and master of technology in farm machinery and power, Indian Institute of Technology, Kharagpur. Soil Conservation work experience since June 1959, as assistant agricultural engineer. Available August 1961. Salary $2,500. W-379-83

Agricultural Engineer for design or research in power and machinery, farm structures or electric power and processing field, with manufacturer or public service agency. Any location, but prefer South. Married. Age 23. No disability. BSAE, 1960, Louisiana State University. Farm background. Worked for Veterinary Science Research Department 4 years while in school. Since graduation research aid (sugar cane research) with Louisiana Agricultural Experiment Station. Available on reasonable notice. Salary open. W-365-84

Agricultural Engineer for teaching, research, writing or management in power and machinery, product processing, or materials handling, with industry or public service in southern or southwestern area. Will travel. Married. Age 43. No disability. BSAE, University of Tennessee, 1947; MSAE, Pennsylvania State University, 1960. Farm background. With farm equipment manufacturer 9½ years in sales, sales promotion, service, advertising, product testing, and general management. Extension agricultural engineer 3½ years with special responsibility in materials handling, processing, and field harvesting. War non-commissioned service in Army over 4 years. Available on reasonable notice. Salary open. W-383-85

Agricultural Engineer for development or research in soil and water, hydraulics, or rural electric field with industry or public service, anywhere in USA. Willing to travel. No disability. BSAE, 1959, Montana State College. Additional courses in irrigation engineering and conservation at California State Polytechnic College. Summer work experience while in college on hydraulic and irrigation research. Currently lab technician with chemical company. Military service 2 years in Arab Legion of Jordan. Available on two weeks notice. Salary $5,000-6,000. W-376-86

Agricultural Engineer for design, development, research, extension, or teaching in soil and water field with consultant, trade association, or public agency, anywhere in USA. Overseas where family can accompany. Married. Age 31. No disability. BSAE, 1951, Washington State University. MSAE expected June 1961. Farm background. Washington State Extension Service in irrigation system design 3 years, agricultural agent for irrigated agriculture, 2 years. US Bureau of Reclamation 2 years as agricultural engineer handling irrigation system design training course for new employees, and problems in development of irrigated land. Arabian American Oil Co. one year as irrigation and drainage consultant in Saudi Arabia. Available July 1961. Salary open. W-355-87

Agricultural Engineer for teaching or research in power and machinery with public service or industry in South or West. Married. Age 44. No disability. BSAE, 1941, University of Missouri. MSME, 1960, University of Washington. Experience 19 years in machine design, including tractors, engines, foundry equipment, and ordnance equipment. Available on reasonable notice. Salary open. W-394-88

. . . Membership Applicants

(Continued from page 777)

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Holt, Ronald — (University of Illinois) c/o Cova Holt, R.R. 1, Potomac, Ill.

Huggins, Larry F. — (University of Illinois) R.R. 1, Macon, Ill.

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Kirk Ivan W. — (Clemson College) ARS, USDA, Texas Technological College, Lubbock, Tex.

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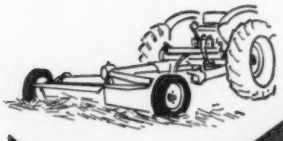

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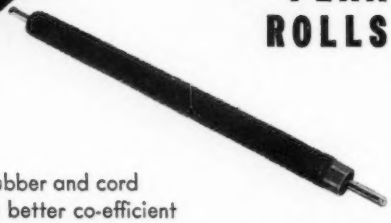

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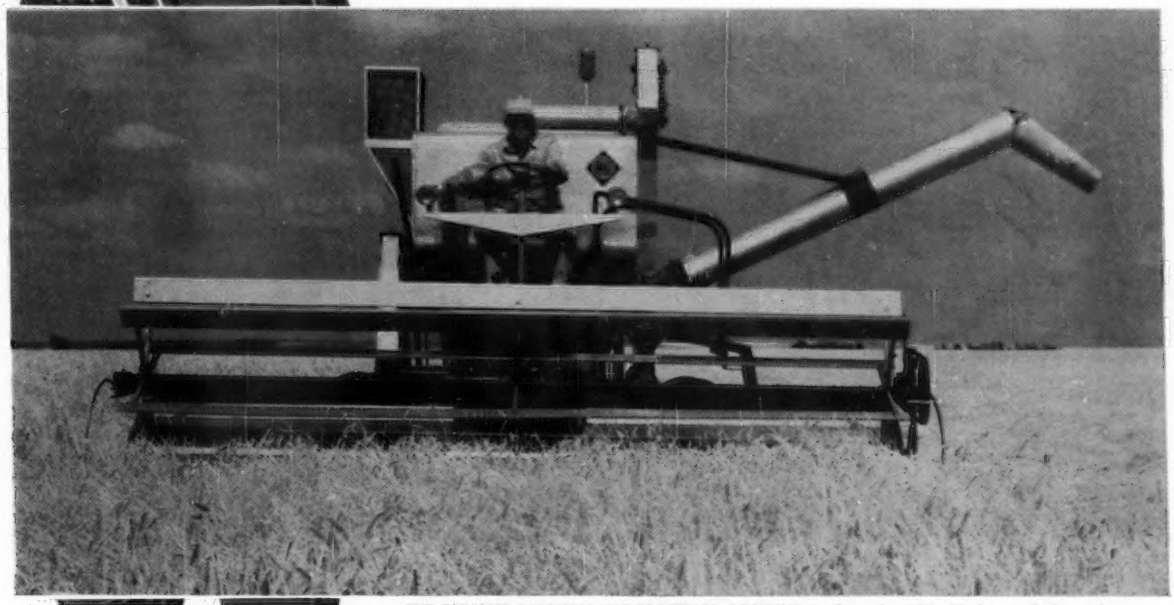

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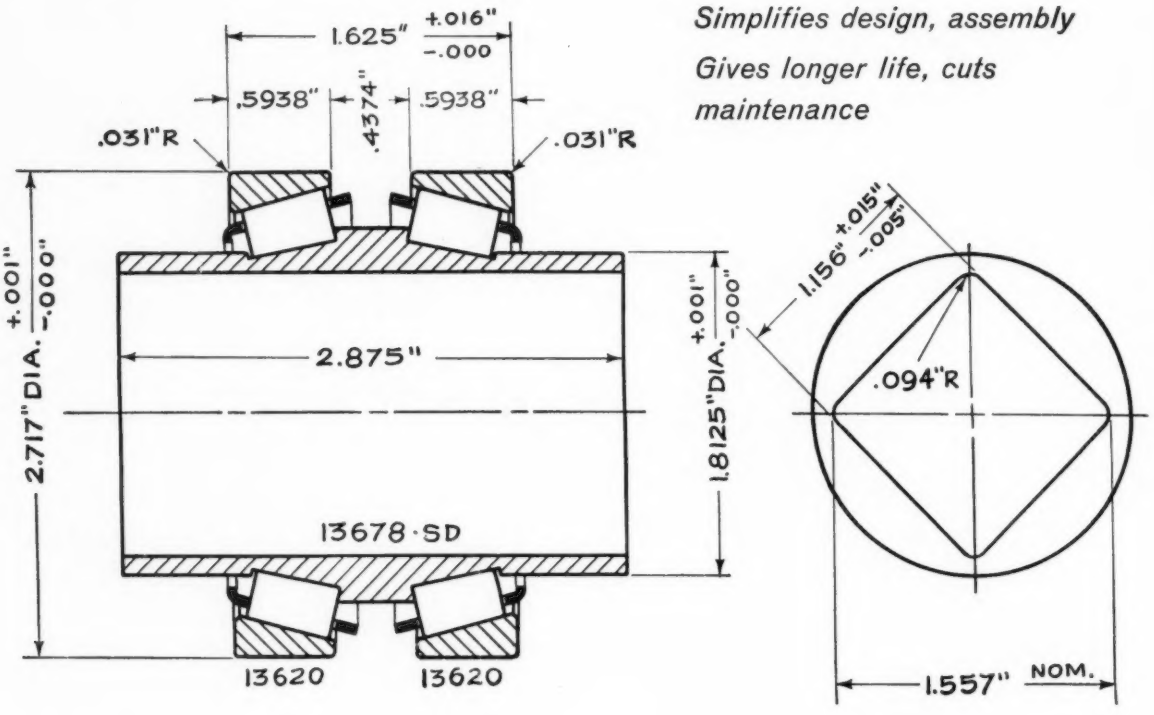

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